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Electrical World

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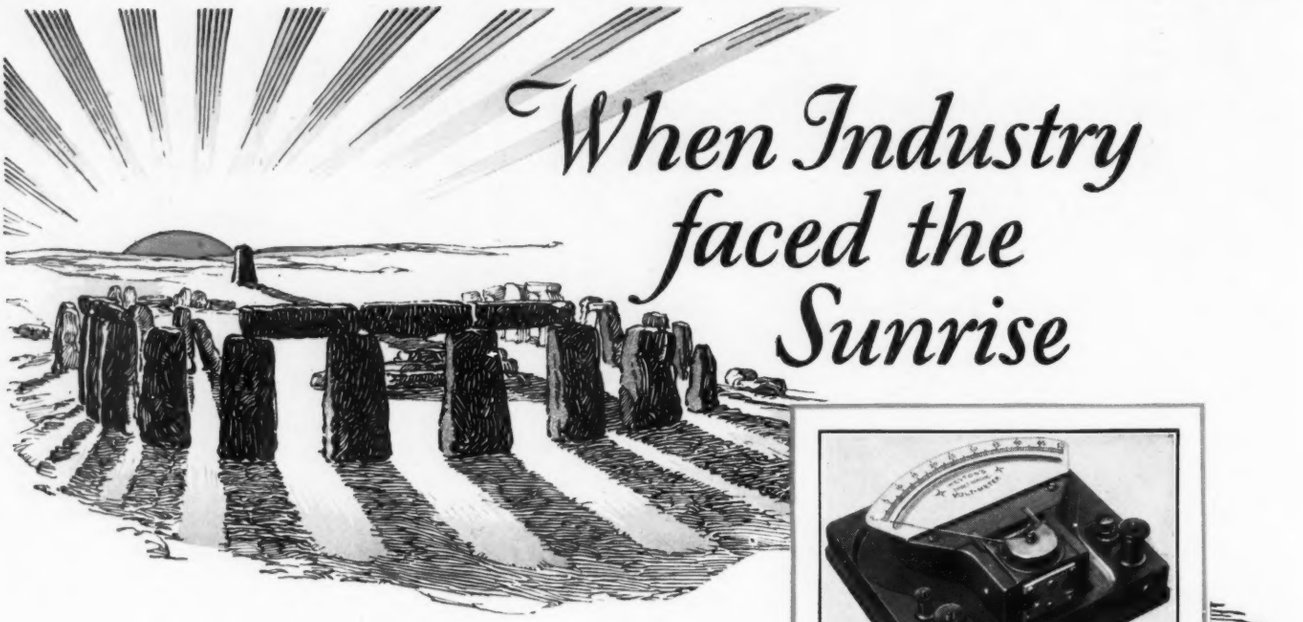
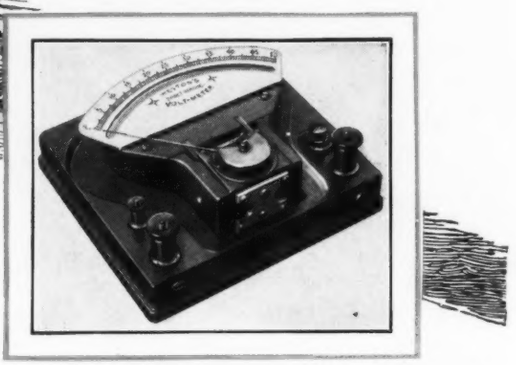
Lengthening
Shadows
Year after year ever-lengthening shadows are cast by Kuhlman Power, Distribution and Street Lighting Transformers serving an ever-lengthening list of well-satisfied users.
KUHLMAN ELECTRIC COMPANY
BAY CITY, MICHIGAN
KUHLMAN
TRANSFORMERS



When Industry faced the Sunrise



Model One without cover. The first Weston—made in 1888

AT THE SUMMER SOLSTICE of a year remote in the world's history a Druid priest stood at dawn within a narrow enclosure of rude stones - newly erected and dedicated to the worship of the sun.

Expectantly he awaited the sunrise. As the glowing orb appeared above the horizon a huge monolith, standing far out in the path of its slanting rays, cast a long prophetic shadow exactly upon the altar stone behind the priest.

Thus Stonehenge, that famous English monument upon the Salisbury Plain, ushered in the first Druidical New Year. But, more than this, it still stands, after nearly four thousand years, as evidence of the fundamental urge of mankind for scientific truths.

Facing the sunrise, the temples of ancient peoples have left unmistakeable evidence of primitive scientific attempts to penetrate the great mysteries of creation, and to fix with *exactitude* the cosmic laws of life.

Coming down to modern times, the world's social and industrial structure is founded largely upon scientific knowledge—successive dawnings of discovery throughout the ages—now culminating in an era of electrical development, the most enlightened period the world has ever known.

Yet, without the means of intelligently investigating and *accurately measuring* the new power—Electricity—the development of its manifold applications to industry would have been retarded, and many of them would have remained utterly impractical and unfinished experiments.

One of the first pioneers in the new science, Dr. Weston, as early as 1875, attracted wide attention by his contributions to the electro-plating industry. There followed his redesign and manufacture of the dynamo electric machine, and its first commercial development. It was also in Weston's factory that the arc light and the electric current for power transmission are said to have received their first industrial application.

Then in the year 1888, through his discovery of alloys having a negligible temperature coefficient, there was presented to the scientific world its first accurate electrical instrument It was then that industry really faced the sunrise, destined to enjoy its longest day of progressive development.

Throughout the past forty years every major contribution to the art of exact electrical measurement has been made by the institution that Weston founded. Therefore, it seems fitting, in commemoration of our fortieth anniversary, to review during the coming year the outstanding achievements which we have made available to the Electrical Fraternity throughout the world.

We continue upon this work with a New Year's pledge that Weston's traditional craftsmanship shall ever be devoted to the highest ideals of service.

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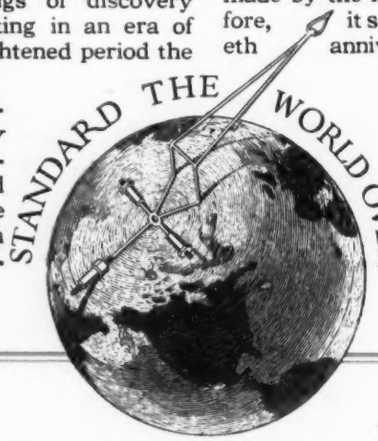

Fortieth Anniversary

Weston
PIONEERS SINCE 1888
INSTRUMENTS

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Available Markets?

THE Business News and Market Conditions Department of the ELECTRICAL WORLD helps the manufacturer determine the available markets and the buyer to determine market conditions. Every week business done in various sections of the country is reported, and, in addition, a list of construction projects contemplated is given. Care is used not to include among such projects alleged plans based only on rumors. The construction news formerly printed on a separate page is now included in the market conditions survey, and under each territorial division worth-while projects are listed.

While the department referred to specifically covers business conditions and lists definite construction news, many other news items contain a potential value as to construction plans. In the ELECTRICAL WORLD each week will be found news covering every branch of the industry, and its departments furnish complete data on available markets.

The ELECTRICAL WORLD news and markets reporters are trained men. They have been selected carefully and have built contacts in every important locality in this country and many abroad.

The Statistical Issue is Jan. 7.

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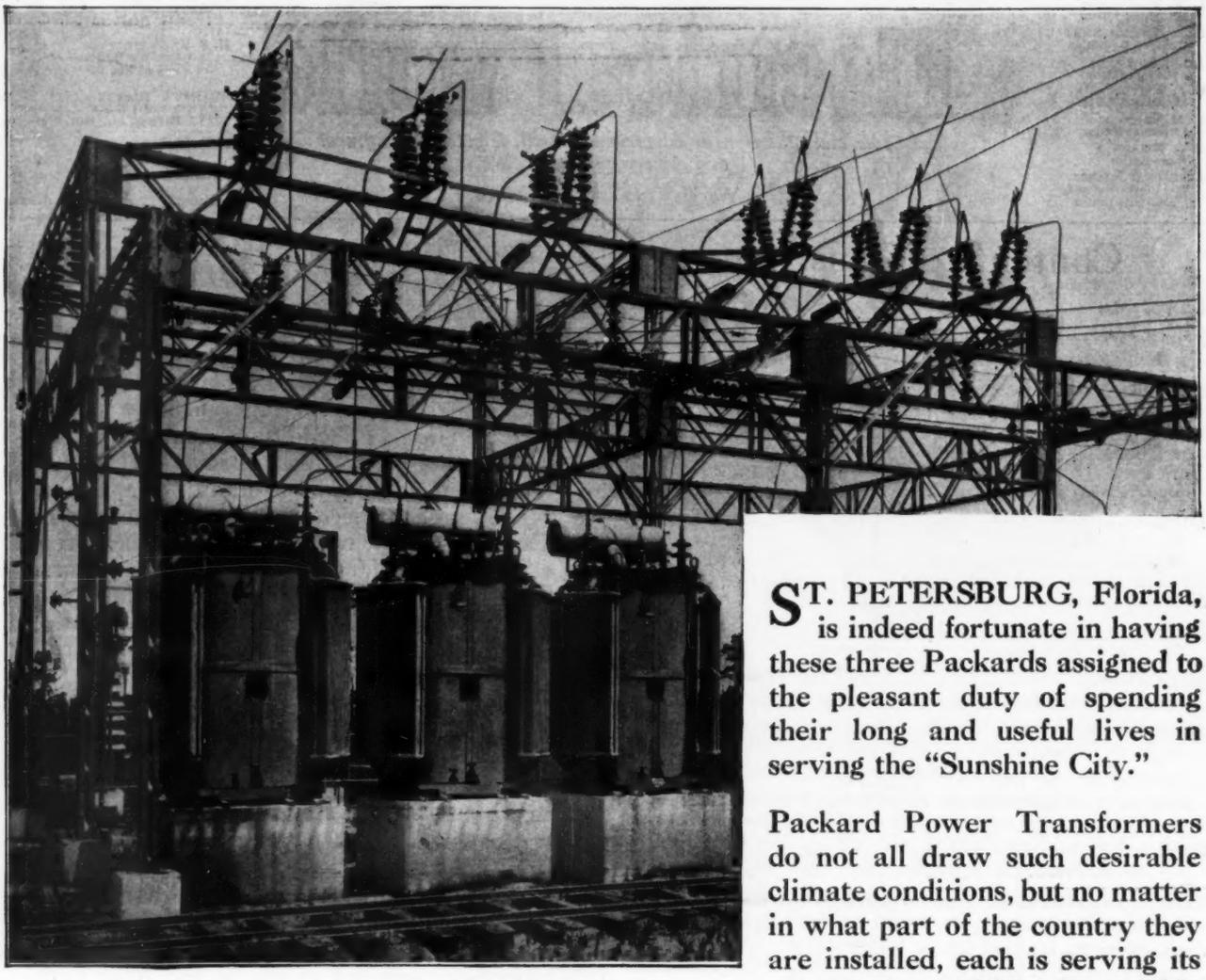

Bank of three 1667 kv.-a. Packard Power Transformers at the Diston Avenue Sub-station of the Florida Power Corp., at St. Petersburg. These transformers are equipped with expansion tanks. Voltage on high side of line 66,000 and on low side 11,000.

ST. PETERSBURG, Florida, is indeed fortunate in having these three Packards assigned to the pleasant duty of spending their long and useful lives in serving the "Sunshine City."

Packard Power Transformers do not all draw such desirable climate conditions, but no matter in what part of the country they are installed, each is serving its purpose in a highly dependable manner.

Reliable and uninterrupted performance of Packard Power Transformers is responsible for the increased service value per dollar invested. The highly efficient design which makes possible the low operating cost of Packard Power Transformers is called "Honest Value," and it is just that.

The Packard Electric Company Warren, Ohio

Packard TRADE MARK

is never seen, except on goods of honest value

Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 90 — *New York, Saturday, December 31, 1927* — NUMBER 27

The Annual Statement and the Personal Call

ANNUAL reports are now impending. What a great thing it would be if the chief executives of every corporation that intends to publish a report this year would ask himself, before he starts, the simple question: What is it that this report is supposed to accomplish? To which, of course, the answer would be obvious enough. The purpose is to tell the stockholder and the investor how the company has prospered in the past twelve months. And then it is to be hoped that this chief executive we have in mind would ask himself the further question: What should I tell this stockholder, this investor? What would I say to him if he were sitting here in my office now? For, after all, this should be the frank approach to an annual report. But the fact remains that what the average corporation tells to any interested guest and what it presents in its yearly statement are as different as a warm smile and a cold stare.

Too many annual statements are left to the treasurer to get out. The treasurer, having his mind focused on the balance sheet and the dollar record of the year, produces a financial report as short as possible and utterly impersonal. The president may add a page of general remarks still formal and without a spark of human interest. And yet this treasurer and the president know well—should they stop to think about it—that if a stockholder or an investor were to call upon them in person seeking information about the company and receive no more information than the statement contains, he would go away disgusted and incensed. For when a stockholder calls he finds a welcome, and the president tells him with pride of the achievements of the year, the growth of the organization, the improvement of the product, the extension of the service. He gets a picture of the human side of the business. They have a friendly visit.

The annual report is for the thousands who cannot call. It should carry to them the same kind of a frank story, the same clear picture of what has been done. Some power companies and some electrical manufacturers have already begun to make this kind of yearly statement, It is to be hoped that many more this year will awaken to this opportunity and obligation.

* * * *

Good Intentions Gone Wrong

GRAFTING new ideas on old habits of thought sometimes produces action of a strangely hybrid nature. Just as there are a few executives and managers who still have difficulty in substituting the modern conception of public relations and service ideals for the old-time indifference to public opinion, so there are employees, and many more of them, who are in the throes of similar adjustment. This mental condition results frequently in the disguise of good intentions under the outworn cloak that went with an earlier method of treating customers. A case in point:

A man living in a large city made some changes in his home, among them the installation of a complete set of new fixtures using more and larger lamps, an electric refrigerator and one or two other motor-operated devices. He received no bill for the first month under the new conditions. But one day there appeared at the back door a taciturn individual who informed the maid that he wanted to go into the basement. Upon being questioned by the wife of the owner, he said that he worked for the electric company and that he wanted to look at the meter. It was not until direct demand was made that he displayed his badge and identification card. After he was admitted he wandered around in the basement for a time and then decided he would look through the rest of the house, which he started to do. So far he had not divulged the purpose of his visit; he had not talked at all since his entry. When the housewife came upon him making an interested inspection of the rooms on the first floor she put him through a cross-examination. After many questions he, with apparent unwillingness, confessed that he had been sent out to investigate the large increase in use of energy as shown by the meter reading.

Here was a utility, animated by a laudable motive toward good public relations, forced to take a ridiculous and unhappy aspect in the eyes of a customer. It did not occur to the man to state his errand when his knock at the door was answered. He was on company business, which was no business of the customer so far as he was concerned. And because, before the bill was sent out, the company wanted assurance that no mistake had been made, the customer got the idea that the company was afraid to render a bill that looked high.

* * * *

Louvain Memorial to American Engineers

THE American engineering societies have undertaken to raise sufficient funds with which to place in the tower of the magnificent new Louvain Library, in Belgium, a clock and carillon. These will be erected as a memorial to the United States engineers who died in service during the war. About $80,000 will be required, one-fourth of which is the allotment of the American Institute of Electrical Engineers. The library building itself is the gift of men, women and children of the United States, who contributed their mites through a popular subscription some years ago, and it remains for the engineers of the country to put the finishing touches to this monument.

Singing towers are characteristic of the "low countries" bordering the English Channel, and, as an expression of American good will to Belgium and a perpetual memorial to American engineers, a carillon and clock

are most fitting. The music of the carillon is heard for miles and will in the years to come carry a message of international friendship not only to those within hearing but far beyond. The United Engineering Societies are behind the effort of the American engineers, and no one can doubt that a general and generous response will be made to their appeal.

* * * *

Use of Electric Ranges by Employees Aids Public Sales

ACCUSATIONS frequently are made that the electrical industry does not practice what it preaches when it comes to using electrical appliances in the home, particularly the electric range. Generally speaking, the shoe fits the foot, and the electrical industry would do well to concentrate on its own internal sales job for a time.

Realizing that the electric range is a good entering wedge in electrifying the home and that central-station employees using ranges are an aid in breaking down sales resistance, California power companies will put on an "employee range campaign" during February, making special inducements in the way of price, terms and wiring cost. In four large Pacific Coast power companies 50 per cent of the employees use electric ranges in their homes. This indicates what can be done. In one company 76 per cent of the employees maintaining homes use electric ranges, while in another 72 per cent are range users. It is a notable fact that resistance to the sale of ranges is less in the territories served by these companies than in many others, and it is also true that a high percentage of the domestic customers of these same companies cook electrically.

Further proof of the value of the use of electric ranges by employees may be summed up in the words of one central-station executive who said: "Great value results from a large proportion of employees using electric ranges in their own homes, as all such employees come into contact with the public and can make a good sales talk on electric cooking from personal experience. The fact that a large percentage of married employees of our company cook electrically must certainly influence the buying public favorably."

* * * *

Experts and "Home Rulers"

A STAFF of able specialists is constantly available to power companies under first-class centralized management. This is a basic reason for the rapid development of the utility industry. Independently managed companies cannot afford to rely exclusively upon their own technical resources any more than can the syndicate properties, but in many cases it "comes harder" for the "home rule" management to call in outside experts on account of the direct cost of their service and the impression such outlays make upon locally minded directors. In reality there is no better mark of a broad-gaged conduct of affairs than for the management to utilize the judgment, experience and analytical powers of engineering, commercial, financial and other specialists with much the same freedom as that with which an active and valuable executive resorts to motor transportation to save time and money.

Mental inbreeding creates sluggish development of properties, wastes money through failure to seize upon new methods and in time threatens popular good will. There are still executives in the power field who regard themselves as all-sufficient to the needs of their companies and who grudge the expenditure of money to send their key men to visit other properties, to participate actively in association work and repeatedly to invite consultants to present opinions and reports upon their problems. In industry circles these companies often possess unenviable reputations for ultra-conservatism. Extravagance is no virtue, to be sure, but liberal use of expert knowledge bought in the open market is a sign of managerial competence on properties of the independent type. Even where the local staff deals capably with difficult problems, the use of outside consultant services as checks upon procedure where substantial costs are involved may be worth many times the expense.

Fortunately, the practice of calling in the best-informed opinion to deal with important and involved questions is increasing as the standards of management rise, and the outlook was never better for approaching such issues along the line of the most intelligent solutions. In the coming year it should be easier than ever before to obtain executive approval and directoral sanction of reasonable fees for competent consulting service, for singly managed properties need outside advice in many cases far more than do those under group direction.

* * * *

New Fields for Old

NOTHING in this world is ever finished. Apparent completion lies in the complacency or the elimination of the observer. Progress or decline is the superficial flux of fundamental immutables. That one phase of an activity is apparently brought near to a conclusion indicates that a variation is waiting around the corner with a club for the short-sighted man. The installations of electric motors and group drives has proceeded splendidly under the efforts of commercial departments, but there can be no termination of intensive power sales programs. When, for example, the motor field has been well covered the newer factor of industrial heating and welding enters the situation.

The bugaboo of higher energy cost for electric heat is shown to be a pitiful illusion when manufacturing costs over sustained time periods are compiled. The engineers of one of the largest manufacturers of electrical apparatus and equipment recently demonstrated, through experience in their own plant, that, in addition to the recognized processing virtues of electric heat and welding, the cost item is in many instances strongly favorable to the electric method. Prophets are notoriously without honor in their own country, and it is not surprising that the manufacturer was reluctant to accept the findings of his engineers.

It is unfair to compare electric heat applications and other methods of securing the result upon the basis of B.t.u. or equivalents. It is the over-all cost that is of importance. When data for the processing of materials are compiled according to pounds of product treated or upon monthly costs, and when all factors, such as maintenance, fixed charges and floor space occupied, are included, it is frequently found that the electric way is the cheapest way. The manufacturer mentioned previously soon found that there was not the slightest justification for retaining his former shop practices, even though several furnaces were comparatively new.

Analyses indicate that in most instances electricity constitutes a small percentage of the production cost of

heat-processed materials and thus represents, whether more or less costly than other methods of obtaining the results, but a small portion of the total charge. The undeniable advantages of electric heat leave small obstacles indeed in the path of the well-informed power salesman. Industrial heating offers a splendid and scarcely touched activity.

* * * *

Buying and Bargaining Are Not Synonymous Terms

WHETHER a purchasing agent buys or bargains for a product depends largely on his attitude toward the relationship of his department to the company as a whole. If the purchasing department must show a direct profit in dollars and cents, then goods must be bought at the lowest first cost, while if, on the other hand, material is purchased on the lowest cost per annum, the purchasing department would not be able to show benefits directly. But there can be no question as to which method will in the long run pay the buyer the most dividends. As an example of this there can be cited an experiment made by a manufacturer some years ago. In quoting, he purposely asked a price $3 per carload higher for shipment from one plant 150 miles from the point of destination of the goods than from the other plant, which was 600 miles from the point of destination. The order was placed at the lower price, although obviously the total cost to the buyer was greater. This purchasing department was setting up a paper profit and actually showing an apparently profitable transaction. A practice more recent was to ask for a special discount to "show a saving."

Unless a purchasing department is close enough to the operating department so that there is a bond of sympathy between them, and unless purchases are made with the viewpoint of efficient operation of the company as a whole, bargaining is the rule. In that case progressive companies are at a marked disadvantage and development and research are throttled. The reaction to the buyer cannot be anything but negative.

But when goods are bought on the basis of service, quality and price, the buyer encourages development and maintains a group of progressive manufacturers prepared and able to follow developments in the industry closely, to the benefit of all concerned, including the public.

* * * *

Residential Markets Beckon

CUMULATIVE evidence of the value of the market for residential electric service appears in every painstaking analysis of local load-building possibilities. A recent study of the so-called small user and his patronage by the Cambridge (Mass.) Electric Light Company reveals the interesting point that approximately one-eighth of the total number of residence customers use 10 kw.-hr. or less per month, or 80 cents' worth of energy at present rates. This group of arbitrarily classed small users embraces 3,223 accounts, of which 1,363, or 48.1 per cent, live in high-grade residential neighborhoods; 665, or 23.6 per cent, live in average neighborhoods, and 796, or 28.3 per cent, reside in sub-average districts.

The proportion of small users in the total number of residential customers is not surprising, but the fact that nearly half occupy the highest class of home areas is significant. Eighty-four occupants of single houses are included in this group, with 621 families in two-family and three-family homes, and 658 apartments of the best grade. Ninety-seven single houses, 530 two- and three-family houses and 38 apartments are in the average neighborhood group of small users, and the sub-average is composed of 53 single homes, 541 two- and three-family houses and 202 tenements. From these figures it would appear that the single houses of each neighborhood are consistently the best of the small customers from the usage standpoint, that the average neighborhood apartments are also excellent users, and that the occupants of the highest-grade apartments and of the two- and three-family houses in all neighborhoods falling within the small customer class are as yet relatively poor users when judged by the 10-kw.-hr.-per-month standard. Of course, it would be unsafe to generalize too far on the basis of data applying to one-eighth of the total number of residential customers, but the above figures at least indicate the status of the small customers with respect to home and neighborhood classification. A study of all residential usage and bills might change the accentuation of classes of homes and territories occupied, but it is well to know the status of each group of small users *per se* in establishing rate structures and, as in Cambridge, demonstrating the need of a minimum charge and equity of a promotional-type rate to bring out the latent energy-buying power of these customers.

* * * *

Country Highways Are Ready for Lighting

WITH the passing of slow-moving horse-drawn vehicles our country highways have become really highways of traffic. The ever-increasing number of automobiles traveling over them has greatly enhanced their importance. Many roads are now paved or otherwise improved and have, therefore, gained a new economic interest. Such greatly increased usefulness and cost provide powerful arguments for lighting them. Furthermore, the glare from automobile headlights is always less along a lighted street or highway, so that such factors as safety and property damage are worth considering. The supersession of the automobile headlight is not in sight, although the elimination of the more glaring ones is possible even now. But even with headlamps properly designed and adjusted, driving along illuminated highways would still be safer and more comfortable than driving along dark ones.

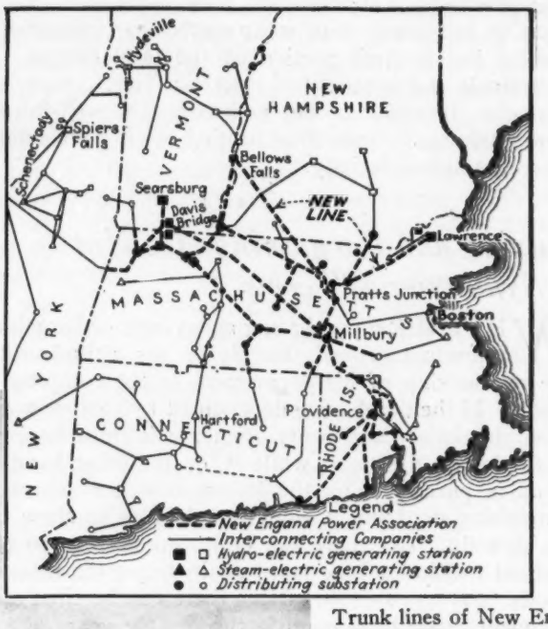
Good highway lighting can be installed for 2 per cent of the investment in highways. This seems a very small amount to spend in order to make our highways so much safer and more useful. Night traffic is now about 20 per cent of the total. If this percentage were doubled by illuminating the highways, an economic gain in their efficiency would be achieved. Lighting of country highways might also furnish in part a solution to the pressing problem of making rural service profitable.

In many communities the lighting of these highways is becoming a live subject. However, like other improvements which new conditions necessitate, this one needs active support and effort. With so many arguments in its favor and with the cost of lighting only a very small fraction of the original cost of pavement—only a small fraction even of the cost of roadbed maintenance—it appears that highway lighting should not be difficult to establish. With all its advantages, has not the time arrived for bringing home this fact to the public?

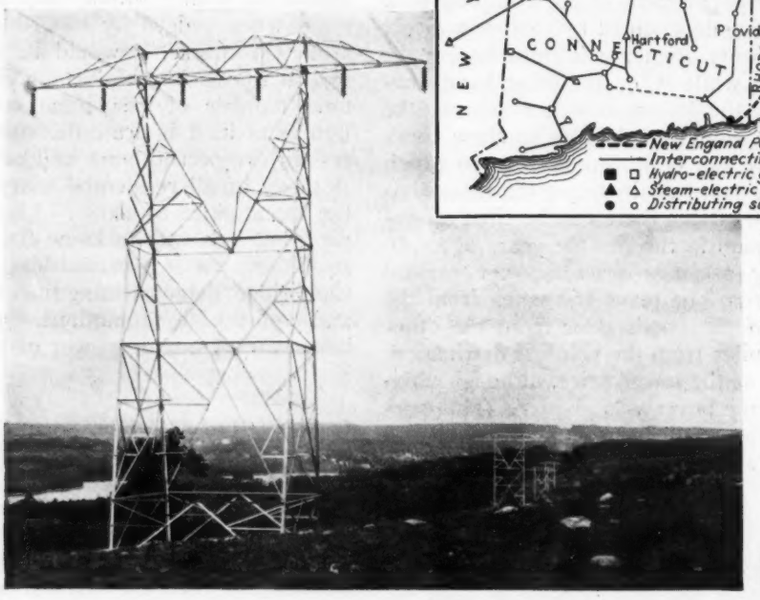
New England System Expanding

RAPID progress is being made by the New England Power Association at its 51,000-kva. hydro-electric redevelopment on the Connecticut River at Bellows Falls, Vt. A 60-mile, double-circuit, 110-kv. line with 70-ft. suspension towers on a 250-ft. right-of-way has just gone into service, connecting this plant with a new switching station about eighteen miles north of the system's operating center.

For some years all important lines of this system have been designed with horizontal conductor configuration to eliminate short circuits from the whipping together of wires when the sleet upon them melts.

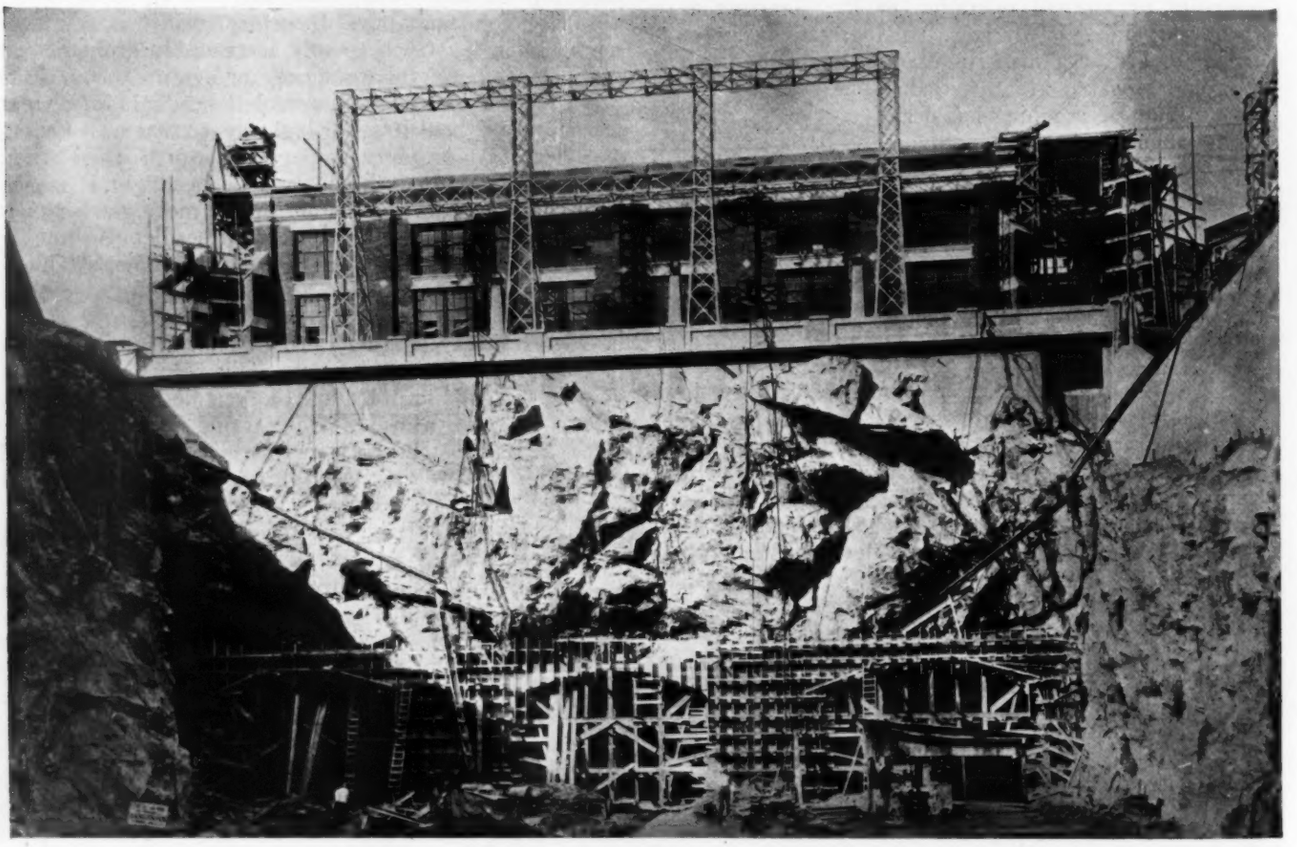


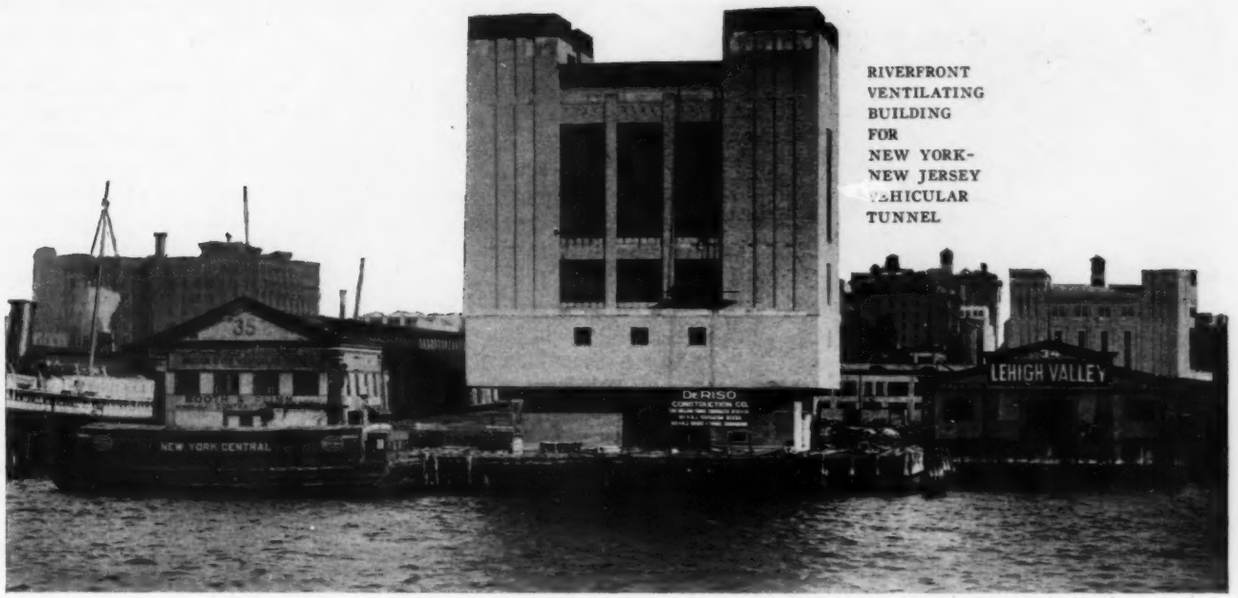
Trunk lines of New England power system, including new tie-in with Boston Edison company and line to Lawrence, Mass.



Bellows Falls power house, transformer bench and tail race under construction.

Bellows Falls-Pratt Junction line.





RIVERFRONT VENTILATING BUILDING FOR NEW YORK-NEW JERSEY VEHICULAR TUNNEL

Reliable Power Supply Makes Possible the

Holland Vehicular Tunnel

Multiple service from two utilities insures continuous supply for ventilating, lighting and control purposes in recently opened New York-New Jersey traffic link. Operation controlled through supervisory board

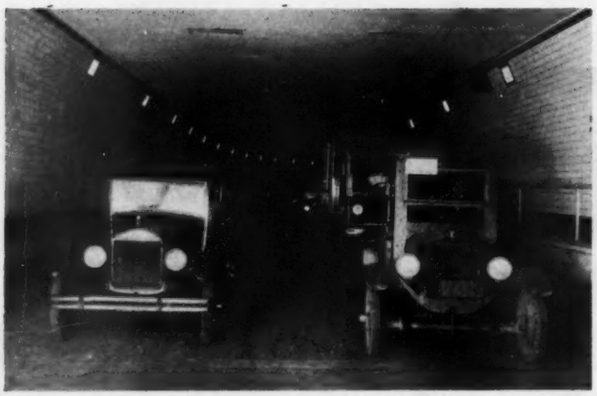
ELECTRICITY has served well in the construction and operation of the new Holland Vehicular Tunnel, which, when opened on Nov. 12, brought New Jersey nearer to New York by approximately ten minutes. In the job of removing 500,000 cu.yd. of excavated material and supplying the light and power and compressed air for this accomplishment, utility-generated energy from two states was delivered under a plan assuring service continuity. The successful operation of the completed project depends absolutely upon an uninterrupted supply of electricity.

Ventilation, lighting, control and signals constitute the essential functions which must not fail. The gases generated by 3,800 vehicles an hour were found to require, for adequate safety, a thorough scavenging of the air 42 times an hour. This necessitates the enormous quantity of 3,761,000 cu.ft. per minute and equipment for insuring perfect maintenance of volume.

Four ventilation buildings, containing a total of 84 motor-driven blower and exhaust fans, are located to render the best possible circulation of air. Two have been placed near the ends of the tunnel on either shore and two at the bulkhead line of pier fronts. Each of the twin tubes is divided into eight sections for operating facility. The motors for ventilation purposes total 6,000 hp., but only 56 fans, aggregating about 4,000 hp., are required for maximum delivery, giving a 50 per cent reserve capacity. The space below the tunnel roadway conducts fresh air from the blower fans in the nearest ventilation building, and a corresponding space above the passageway provides a return path to the exhaust fans in the same building. The unusual feature in the solution of this ventilating problem is the use of transverse air circulation. Air is discharged from fresh air ports along the floor level and removed continually through vitiated air ducts along the ceiling. There is no longitudinal movement of air. With this system the smoke and gases developed by burning vehicles have been shown by tests to be confined to a radius of 30 or 40 ft.

Lighting Units Specially Designed

Illuminating engineering has made important contributions to the success of this undertaking. The avoidance of accidents with the accompanying potential congestion of traffic depends largely upon the proper illuminating effect and gradients. Eye-strain and confusion, attendant upon entering the tunnel from the bright sunlight, is avoided by proper intensities and color values. The illumination must be unfailing, and this has been arranged, in part, by supplying alternate lights from one of the two main sources of energy supply. Twenty feet has been chosen as the normal spacing interval between recessed fixtures, but near the portals and for some distance adjacent to them, shorter intervals are used to



RECESSED LIGHTING FIXTURES AFFORD PROPER ILLUMINATION AND AVOID GLARE

reduce contrasts with outdoor illumination. Uniformity of light distribution is highly desirable to avoid the effect of alternate brightness and darkness. Experiments and research involving the use of model tunnel sections indicated the inadequacy of available equipment.

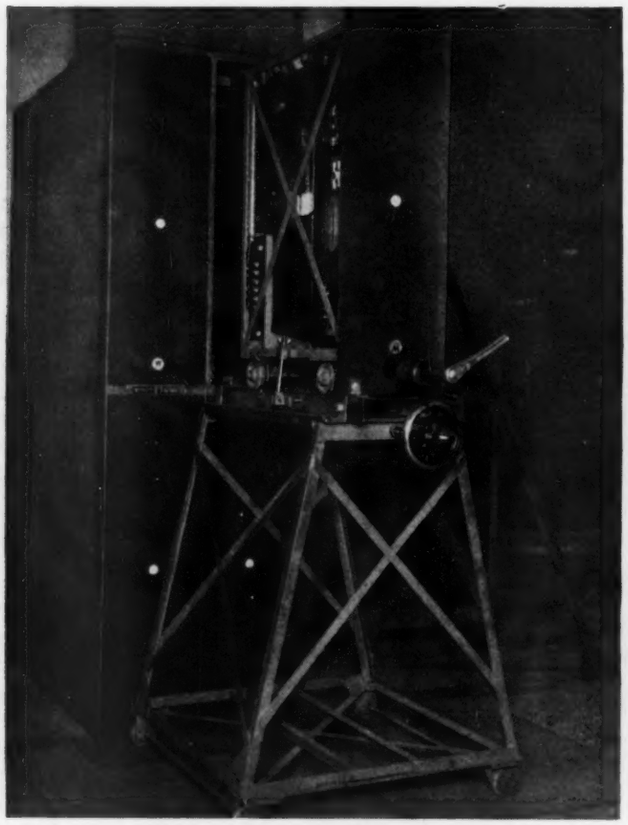
Lighting units with a special housing and porcelain-enameled cast-iron reflector box covered with a refracting glass are used. These boxes are set in the concrete lining of the tunnel and each employs one 150-watt 115-volt clear glass Mazda C lamp. There are six lamps per circuit on a three-wire 220-110-volt service from transformers located throughout the tunnels and fed by taps to the main 2,300-volt feeders. By operating these lamps from alternate circuits and obtaining service from four entirely separate generating stations, the possibility of complete failure of the lighting system is highly minimized.

For the light covers a figured crystal glass is used, permitting maximum light transmission with good diffusion. The roadway illumination ranges from a maximum of 1.4 foot-candles to a minimum of 1 foot-candle. An average illumination of 1.22 foot-candles is obtained 2 ft. above the roadway with 0.75 watts per square foot of surface. This illumination, higher than that customary on city streets, is used because no headlights may be lighted by the vehicles while in the tunnel.

The co-operation of an advisory ceramic engineer enabled the specification and preparation of a special white tile, for the wall facings, to be made. This tile constitutes an essential factor in the lighting plan. Nearly 600 kw. is required for the lighting of this project.

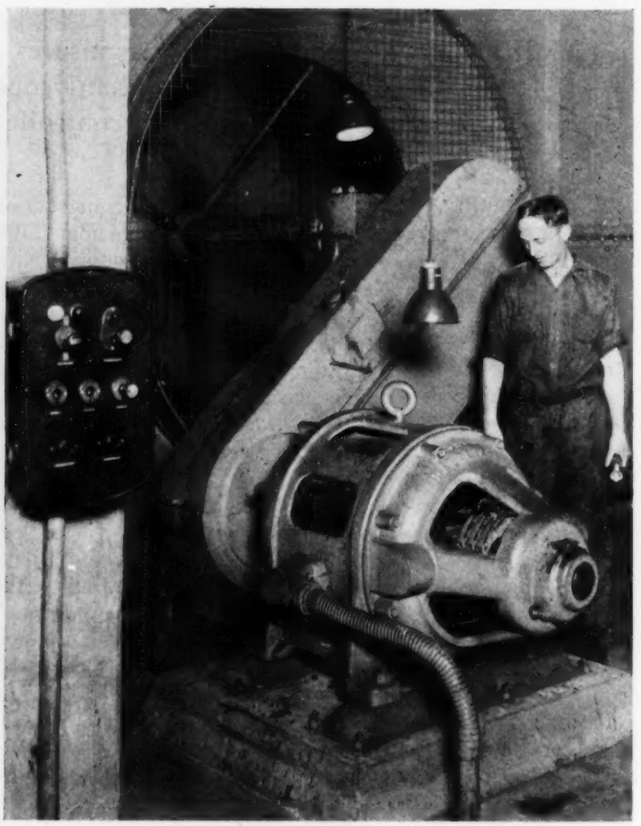
Traffic supervision requires reliable traffic signals, which, in this case, are placed at 240-ft. intervals and are controlled locally by the patrolling officer or remotely by the chief operator. In addition to having a multiple connection with several sources of electric supply, the signal devices may be energized by a storage battery in the event of failure upon a section of the tunnel lighting circuits. Green and red signals have the customary meaning and yellow indicates that operation is restricted to the right-hand lane. The signal "Stop Engine" may be flashed when necessary.

Electric power not only operates the fans, auxiliary equipment and elevators but also drives the pumps for removing water that may find its way into the tunnel, either from rain or snow on the outer approaches or from



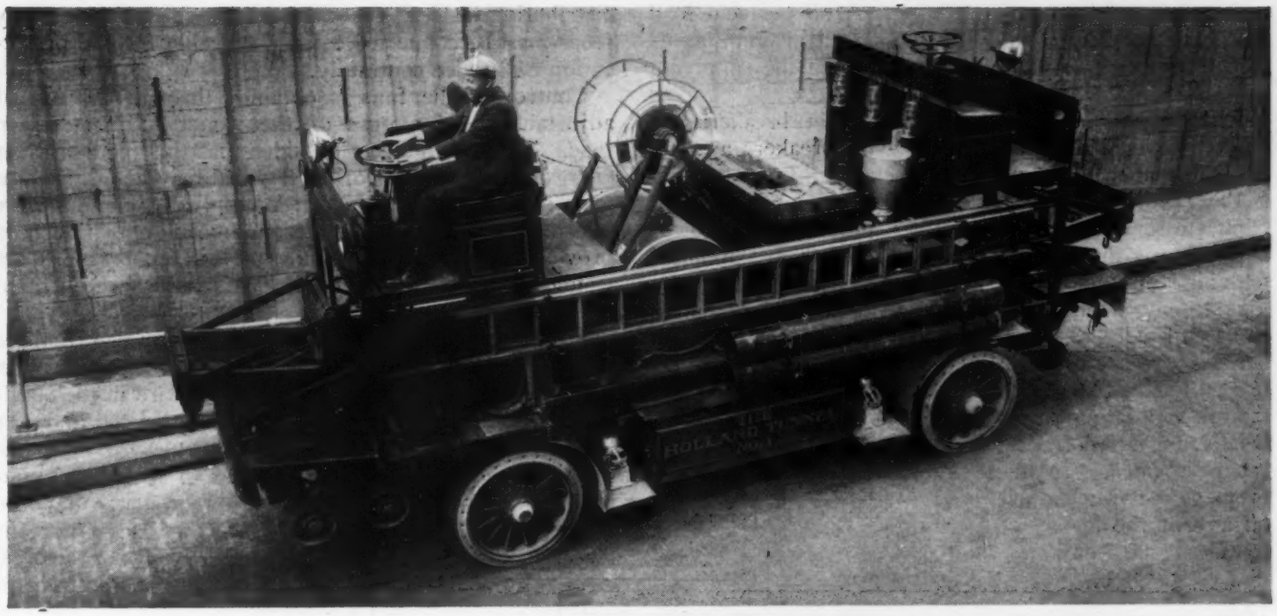
DOUBLE-DECK TRUCK-TYPE SWITCH PANEL

Space limitations required the design of unusual equipment for 440-volt circuits. This is a 600-amp. device. The carriage for removal of trucks on upper tier moves along in front of the switchboard on rails paralleling the board face.



FANS EMPLOY LOCAL CONTROL AND FLEXIBLE DRIVE

Motor operation may be controlled from local station, control board or supervisory panel. Chain drives are used for blower-motor connections offering flexibility and eliminating the necessity for geared connections.



EMERGENCY TRUCK DESIGNED FOR HOLLAND TUNNEL
Storage battery operation is a feature of this combined wrecking car, first-aid supply, fire-fighting and towing vehicle which may be steered and controlled from either end

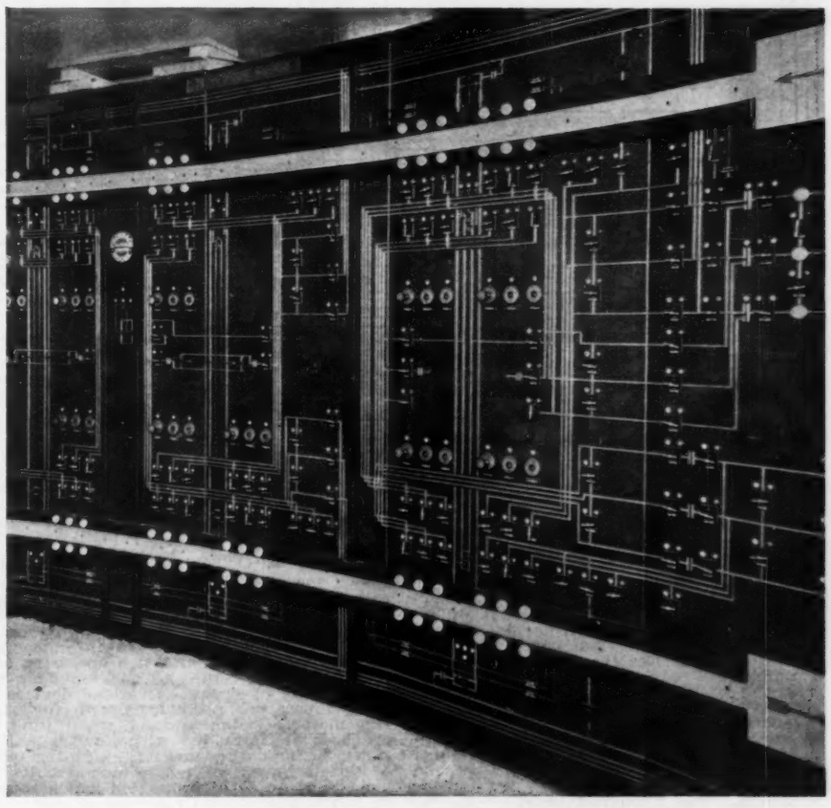
the flushing of the walls and roadways. The charging of storage batteries and the driving of air compressors the output of which is used for blowing out electrical equipment, etc., is accomplished by this service.

Supervisory Control for All Operations

Supervisory control of tunnel operations is afforded through an arc-shaped panel somewhat similar to the familiar load dispatcher's board. This apparatus permits the chief operator personally to operate and adjust the speed of any motor, fan and control, breaker, etc., in each of the four ventilation buildings and throughout the rest of the tunnel system. Indicating lights show which fans are in operation and their speed, and the condition of all tunnel signals. A graphic device indicates the content of carbon monoxide gas in each exhaust section, the level of water in the pumps, and which pumps are working, at any instant.

Power Continuity Assured

Every contingency that could be foreseen has been provided for in planning the power supply. The United Electric Light & Power Company of New York City and the Public Service Electric & Gas Company of New Jersey each supplies 13,200-volt, three-phase, 60-cycle power over three circuits leading from power houses and distributing substations. Four generating stations are connected by direct lines to the tunnel substations. As indicated in the accompanying illustration, the circuits have been so arranged and planned and capacity so provided that any portion or all of the load may be fed from any one of the six incoming feeders. Power is transformed from 13,200 to 2,300 and 440 volts by three-winding, air-blast transformers. Six 2,300-volt cables, three from each end, run from one portal ventilation building to the other, feeding double 2,300-volt buses at each ventilation building. At each river-edge ventilating building 220-volt auxiliary power is available from the 2,300-volt buses through transformers. Truck-type panels have been utilized throughout, as they require no special cell work, permit rapid substitution and thereby enable high service continuity. The esti-



SUPERVISORY BOARD CONTROLS TUNNEL OPERATION
Indication of all equipment operation is offered by position lights for each tube.

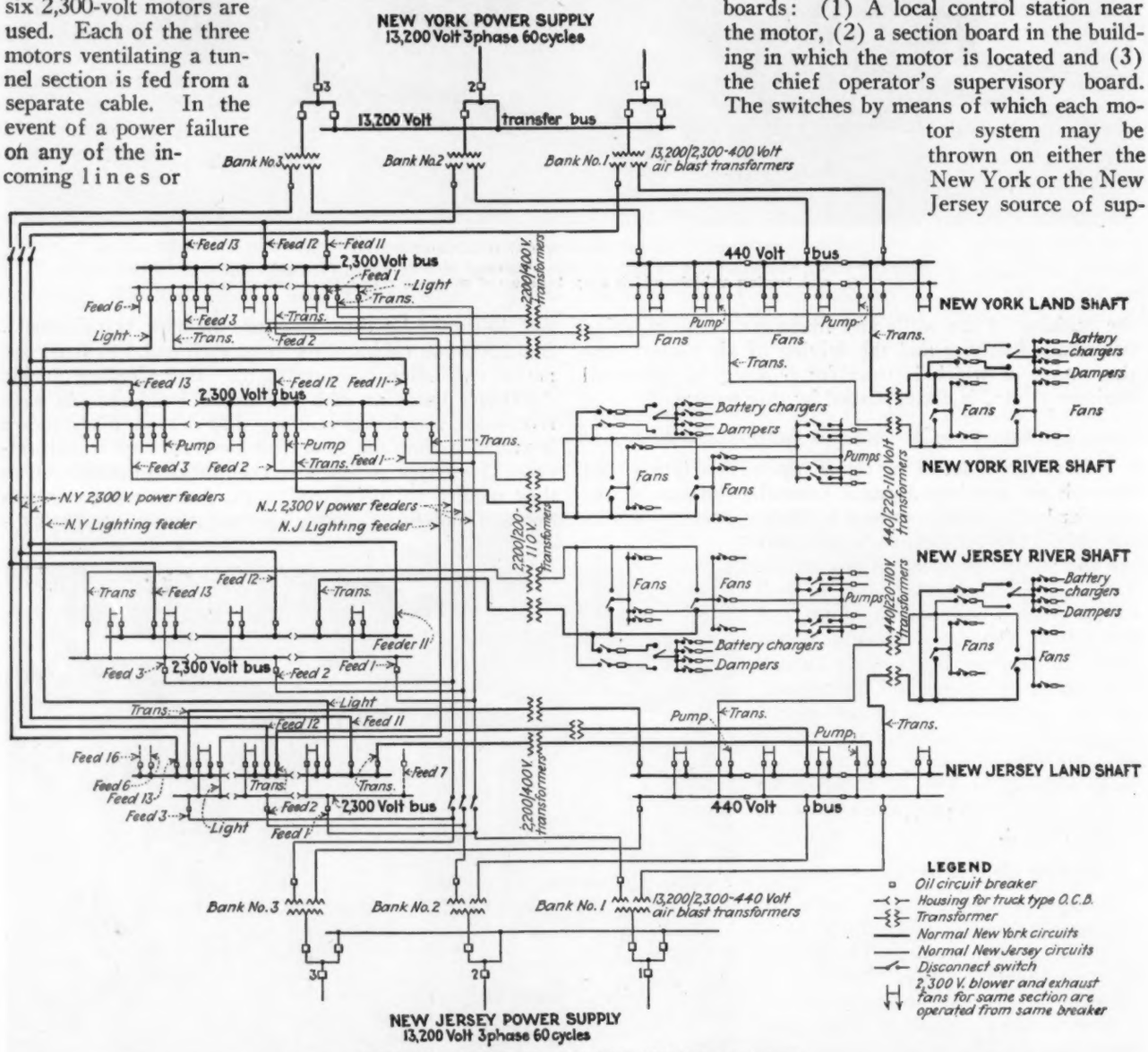
mated demand is about 4,400 kw. A 65 per cent load factor is anticipated and the monthly consumption of 2,000,000 kw.-hr. will be divided between the supplying utilities in practically equal proportions.

The 13,200-volt and 2,300-volt circuit breakers are of conventional design. The 440-volt breakers are unusual in that they are made two decks high to save space.

Power distribution and utilization has centered on triplicate service. There are three fans on each blower and exhaust duct. Three tunnel sections are supplied with air from each river-edge building. The portal buildings supply air in three tunnel sections equipped with eighteen small 440-volt motors and one section for which six 2,300-volt motors are used. Each of the three motors ventilating a tunnel section is fed from a separate cable. In the event of a power failure on any of the incoming lines or distribution cables, the equipment which it normally feeds may be connected to another cable for the preservation of service continuity.

Control of the fans is obtained through the use of adjustable-speed motors of the wound-rotor induction type. Tunnel engineers consider that this method saves energy, as the volume of air handled may be adjusted to meet actual requirements. Wound-rotor motors were selected because of their economy of operation and proved reliability. All motors of 50 hp. or more are wound for 2,200 volts; those of less rating are operated at 440 volts.

Motor control may be effected from any one of three boards: (1) A local control station near the motor, (2) a section board in the building in which the motor is located and (3) the chief operator's supervisory board. The switches by means of which each motor system may be thrown on either the New York or the New Jersey source of sup-



SIMPLIFIED SINGLE-LINE DIAGRAM OF POWER CIRCUITS

Every provision that could be foreseen has been made to insure uninterrupted service for this tunnel. Two utilities in different states supply energy from six sources, any one of which can carry the full operating load. For the sake of clearness, a number of connections for fan drives, from the 2,300 and 440-volt wires have been omitted in this sketch.

Incoming power lines are provided with short-circuit and differential relays. Protection for each of the six transformer banks is afforded by differential relays on the high-tension and on both low-tension windings. The 2,300-volt breakers on the low-tension side have short-circuit equipment and overload devices for bell alarms and lamps. Each feeder connected to the four 2,300-volt buses have overload alarms and short-circuit protection. Each ventilating fan has short-circuit protection with separate overload devices. Short-circuit protection consists of two instantaneous relays making one circuit when operating and with automatic return to position upon removal of short circuit. Overload devices of the temperature relay type, two for each fan motor, closing contact when limit is reached, are provided with hand operated resets of indicating targets. Lighting feeders each have two relays per circuit for time limit overload protection which return to initial position on clearing of line.

All overload, short-circuit and differential relays trip breakers through multicontact lock-out relays which permit only of hand resetting. Short-circuit relays for fans and miscellaneous loads are of the instantaneous type, all others have adjustable features, with inverse time limit characteristics.

Interlocks are of the multiple type with mechanical interlocking features. Eight-switch interlocks are used for breakers on 2,300-volt buses in each land building.

Lock-out relays cut out pilot light resistors, increasing indicating lamp intensities and operating bell alarms.

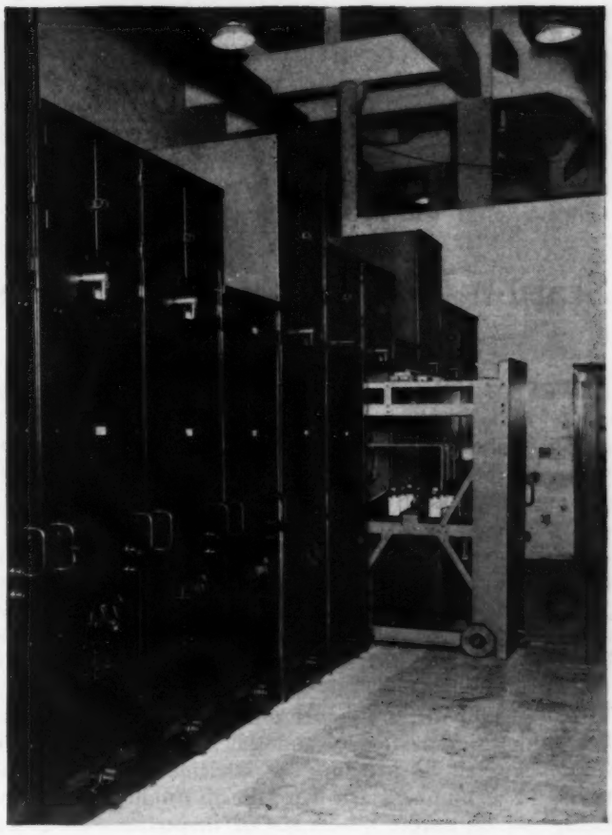
Long-time delay under-voltage relays are provided for motor protection. Instantaneous under-voltage devices protect the motors in the event of interrupted potential. The four main lighting feeders have time-delay and under-voltage protection.

ply are interlocked so that, when one is closed, all power connections for the other are broken. It is impossible to connect a motor to two sources of supply simultaneously. Metals of different colors indicate diagrammatically the New York and New Jersey power supplies on the building and supervisory control panels. The position of switch-operating controls indicate open and closed status and white and green lights serve the same purpose. The divergence from accepted color schemes was adopted to permit the use of a brilliantly arrestive indication (white) for automatically opened circuits.

Any one of three motor speeds may be selected at any of the control stations: 50 per cent, 100 per cent and a speed between 65 and 86 per cent. Acceleration is controlled by air dashpots for short intervals and geared induction-type relays for long intervals. Some of the motors require as long as 40 seconds to accelerate. On each air duct there is a large damper that serves to prevent the air from one fan being blown back through the other. Closing of the switch to start the motor simultaneously opens the damper by means of a small motor. When the motor stops, the damper automatically closes.

There are nineteen electrically driven pumps ranging in capacity from 50 to 1,000 gal. per minute with a combined capacity of 6,850 gal. per minute for sump drainage purposes. With the exception of the 50-gal units, which are of the geared plunger type, these devices are centrifugal. All are automatically operated through float gages which start and stop them in accordance with water-level fluctuations in the sumps. One-half of the pumps will dispose of the inflow that may result from the most severe rainfall on record in New York City. Operation of each pump is indicated in the main control room of the tunnel system.

Four electric trucks are in operation: Two are emergency trucks with double-end steering and two-direction operation, equipped for fire-fighting, towing and first-aid functions; another is an express vehicle; and the fourth is equipped for cleaning, servicing lights and general maintenance.



TRUCK-TYPE CIRCUIT BREAKERS IN 2,300-VOLT SWITCH ROOM

The tunnel also serves the electric light and power companies, for the conduits in the structure will be used as cable ducts for the interconnection of the United Electric Light & Power Company of New York and the Public Service Electric & Gas Company of New Jersey, offering another link in the network of companies joined for mutual and public benefit.

MAKERS OF IMPORTANT EQUIPMENT USED IN HOLLAND TUNNEL

(Furnished by Holland Tunnel Commission)

AMERICAN FIRE PREVENTION BUREAU, INC.—Automatic fire alarm (tunnel).

AMERICAN STEEL & WIRE COMPANY—Lead-covered cable (tunnel lighting), wire and cables (plaza lighting), wire and cable (power and control wiring).

ATLANTIC WIRE & CABLE COMPANY—Rubber-covered cable (tunnel lighting), wiring (building lighting).

AUTOCALL COMPANY—Code-calling system (telephone system).

JAMES G. BIDDLE—Portable testing equipment.

COMMERCIAL TRUCK COMPANY—Electric trucks.

CHAS. CORY & SONS, INC.—Key interlocks (interlocking protection), panels and buttons (traffic control), telephones (tunnel telephones).

EDWARDS & COMPANY—Annunciator (supervisory system).

EMPIRE SWITCHBOARD COMPANY, INC.—Panel boards (elevators).

ELECTRIC STORAGE BATTERY COMPANY—Batteries (telephone system, control system, supervisory system, utility trucks).

FOOTE, PIERSON & COMPANY—Relays (supervisory system).

G. & W. ELECTRIC SPECIALTY COMPANY—Section boxes (plaza lighting).

GENERAL ELECTRIC COMPANY—Airblast power transformers, 13,200-volt truck type switches, 2,300-volt truck-type switches, elevator motors, pump motors, pump motor control.

GOULD MANUFACTURING COMPANY—Sump pumps.

GRAYBAR ELECTRIC COMPANY—Lighting units (elevators).

JOHNS-MANVILLE CORPORATION—Cable protection.

LEEDS & NORTHRUP COMPANY—Recording potentiometers (carbon monoxide recorders).

LINK-BELT COMPANY—Silent chain drives (ventilating system).

F. H. LOVELL & COMPANY—Traffic signals (tunnel lighting), officer's signals (tunnel lighting), lighting fixtures (building lighting).

MINE SAFETY APPLIANCE COMPANY—Analyzers (carbon monoxide recorders).

A. B. SEE ELEVATOR COMPANY—Elevator motor control.

SEPCO PRODUCTS COMPANY—Water heaters.

STANDARD UNDERGROUND CABLE COMPANY—Cables and potheads.

STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY—Telephone board, desk, wall and mine-type telephones.

B. F. STURTEVANT COMPANY—Fans and blowers (ventilating system).

SUNDH ELECTRIC COMPANY—Contactors (fan motor control), damper control board (ventilating system).

UNION METAL MANUFACTURING COMPANY—Lighting standards (plaza lighting).

UNION SWITCH & SIGNAL COMPANY—Relays (supervisory system).

VECO MANUFACTURING COMPANY—Lighting fixtures (building lighting).

WAGNER ELECTRIC CORPORATION—Damper motors (ventilating system).

WAGNER ENGINEERING COMPANY, INC.—Limit switches.

WESTERN ELECTRIC COMPANY—Paper-insulated telephone cables, cable for pumping equipment.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY—Fan motors, resistors (fan motor control), disconnecting switches (fan motor control), reflectors (tunnel lighting), switches, fused (tunnel lighting), oil-insulated transformers (tunnel lighting), switch cabinets (tunnel lighting), contactor cabinets (tunnel lighting), transformers (plaza lighting), panel boards (building lighting), control and relay boards (supervisory system), distribution panels (supervisory system), oil-insulated transformers (power and distribution), control and relay boards (control equipment), battery chargers (control equipment), switches, fused (plaza lighting), lighting fixtures (plaza lighting), battery chargers (telephone system), lighting fixtures (building lighting), relays (supervisory system), portable testing equipment, 440-volt truck-type oil switches.

WESTINGHOUSE-SARVAS COMPANY—Battery chargers (electric trucks).

WESTON ELECTRIC INSTRUMENT CORPORATION—Portable testing equipment.

The following manufacturers also supplied devices used in the electrical construction: American Pattern, Foundry & Machinery Company; Appleton Electric Company; Bishop Wire & Cable Company; Bryant Electric Company; Consolidated Car Heating Company; Crannell, Nugent & Kranzer; Duplex Electric Company; Garland Manufacturing Company; Hart & Hegeman Manufacturing Company; Jenkins Manufacturing Company; Kliegl Brothers; National Metal Moulding Company; Pass & Seymour, Inc.; John R. Proctor Company, Inc.; Russell & Stoll Company.

The construction and operation is under the joint supervision of the New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission. Ole Singstad, chief engineer, carried to completion the task, started by Clifford M. Holland and continued by Milton H. Freeman, in the same capacity. Ralph Smillie and John N. Dodd are engineer of design and electrical engineer respectively.

Station Maintenance Schedules and Plant Records

SYSTEMATIC maintenance, including the regular inspection and repair of equipment and the recording in detail of the results of inspections and nature of repairs, has been the subject of a special study by a subcommittee of the Southeastern N.E.L.A. prime movers committee. Its purpose was to ascertain what methods exist for enabling those directly in charge to keep in intimate touch with their work.

For checking and recording periodic plant inspections many companies in the Southeast use a system of numbers—for instance, the numbers 100 to 199 to indicate weekly inspections, 200 to 299 monthly inspections, etc. The first digit in the number indicates the time that the inspection is to be made, and the last two digits have reference to the inspection of a particular piece of apparatus. The numbers are listed in an "index of inspections," which covers all classes of inspections on every piece of equipment.

Color and Letter Symbols

For convenience in making out and filing reports of inspections several different colors of report sheets are provided, the color also serving as an indication of the frequency of the inspection—for example, orange, yearly; yellow, semi-annual; blue, quarterly; green, monthly. The person who makes the inspection inserts the inspection symbol or number in its appropriate column on the proper-colored sheet with a description of the results opposite. These sheets are usually issued weekly to take care of all of the inspections for the following week.

Another system of inspection schedules uses letter symbols, usually the initial letter of the machine involved, together with such figures as are necessary to confine the activities of the workmen to the particular part or parts for which the inspection is intended. An "index of inspections" in this system, besides assigning an arbitrary number to each particular inspection and directing in detail the usual procedure in the making of the inspection, also sectionalizes the plant equipment under a convenient number of headings for filing purposes and indicates the approximate time at which, and the frequency of which, each piece of equipment is to be gone over. Daily and weekly inspections are of a superficial nature and the results are not recorded, but the records of monthly, quarterly, semi-annual and annual inspections are carefully entered on cards arranged for this purpose.

Experience has shown in many cases that the more skilled the operator the less he is inclined to write an intelligent report. Consequently the most common corrective measures are: First, another person is detailed to act in the capacity of secretary or clerk to the workmen to write up matters of importance; second, a schedule of inspections is prepared for each piece of equipment, describing in detail the conditions that should exist for best performance. When the workman has covered the apparatus in question according to the instructions detailed on his card of inspection, he so signifies by an O.K. in the appropriate space opposite. The tendency under the latter method is for the workmen to depend wholly on the printed form, answering by the abbreviated O.K. when a more detailed report would have been advantageous, so that it will generally be a question for the local plant executive to decide when to rely altogether on the printed forms and when to insist on an individual description of the conditions found and the work performed.

Definite Inspection Procedure

In three stations of the Florida Power & Light Company a list of inspections is compiled for each piece of apparatus in each plant, every inspection setting forth a definite procedure to guide the inspector. When all the plant equipment has been covered by such inspections, the procedures are typewritten and bound in book form. A copy of this book is given to the heads of the operating and maintenance departments. The inspections are classified with respect to the equipment on which they are to be performed, the frequency with which they take place. The electrical features of the procedure are specified in each instance.

The daily inspections are placed in the front of the book, followed by the weekly, monthly, etc. Blank sheets are placed in this "schedule book" for inspections on future equipment. The pages are numbered consecutively and the page numbers and space numbers (each page being divided into ten numbered spaces) constitute the numbers of the inspections. Thus if the title of an inspection is placed on page 14, space 2, the inspection number is 142, the last digit indicating the space and the first two the page.

A maintenance calendar is set up representing each day in the year, 4x6-in. file cards being used. On each card are placed the numbers of the inspections to be performed on that day, there being 364 cards in the calendar, as each maintenance year is taken as 52 weeks even. Each day the station clerk removes the card from the file corresponding to the date and places on the report sheets the inspection numbers on that card. These report sheets are given to the heads of the operating and maintenance departments, who in turn distribute them among their men.

Each inspector refers to that portion of the schedule book in which the procedure for the inspections corresponding to the numbers on his report sheet are listed. On his report he makes a complete description of the inspections carried out, the work done and the general condition of the equipment. These report sheets are in reality job orders, as they set forth the maintenance work to be done each day. These sheets, when filled out, are kept in a special binder so that a permanent record of the work is available at all times.

The time interval between overhauling or complete inspection is based on a definite period as set up in the maintenance calendar. This interval is based on the nature of the duties of the apparatus, its past maintenance requirements and the manufacturers' recommendations. If, however, the daily inspections show the equipment to require attention, an overhauling may be carried out regardless of the schedule time period. Records are kept of such emergency jobs.

Dielectric Value of Wood*

in Line Insulation

Practical considerations and successful use of wood indicate inherent advantages of this material. Steel tower and pole construction practices compared

By A. O. Austin
Chief Engineer Ohio Insulator Company

UNLESS wood pins raise the insulator well above the cross-arm they do not set up as good electrical conditions as a metal pin of the customary length. Where a metal pin is used, the charging current of the insulator tends to set up a more favorable field or charge on the cross-arm so that the tendency to discharge from the conductor to the arm with an ungrounded brace is reduced.

Metal pins should have more attention when used, as a poor design of pin will start overstress prematurely, greatly lowering the insulating value of the structure. Many lines experiencing trouble with wood construction can eliminate much if not all of their electrical troubles by care and attention to some of the details mentioned.

A defect in design or in the proper combination of insulator and pin, although hardly noticeable on a 60-cycle test, may be serious under an impact and results in many cases of trouble with a line that should be practically free from trouble.

Use of Wood Arms

Wood arms afford much insulation and their value should not be overlooked on distribution lines using insulators of moderate size. The effective use of wood arms frequently eliminates much bird trouble that would occur with a steel arm. A bird standing on a steel arm may shunt the insulator and start an arc at normal frequency that may not clear. Birds standing on a wood arm may receive an appreciative discharge, but a power arc seldom follows.

Good length in the arm is advisable to counteract several electrical conditions, particularly where the pole is shunted by a lightning rod or where a pole of steel construction has been used.

A comparison of Figs. 3 and 4 shows how wood may be utilized to advantage in the cross-arm. The discharge would normally take place between conductor and arm instead of between conductor and body of the tower. The discharge potential has been further raised in Fig. 4 by the use of insulated controls and conductor cages to such an extent that a discharge is seen striking from conductor to ground, a distance of 15 ft. Providing good effective length in the wood arm also tends to clear the arc on distribution circuits.

The use of the wood arm on a steel structure is not new, as many transmission companies have made use of it. The Montana Power Company apparently considered a 60-kv. pin insulator mounted on a wood arm as equivalent insulation to a six-section suspension insulator hung from a steel arm. It has been the practice of the New York Central Railroad to use wood arms on its 33-kv. steel tower lines supplying the electrified zone for years, and there are, of course, many other interesting examples.

Where wood arms are used, it is necessary that conditions be such that the arm will not burn due to leakage and charging current. Burning can be prevented by a high shunting resistance and shattering by a shunting gap.

The wood arm is particularly applicable to old lines where it is desired to raise the arcing potential and clearance will not permit an increase in the insulation. With the wood arm, vertical clearance is not such a limiting factor, as the discharge will not take place to the arm below, even though the length of the insulator is materially increased.

It frequently occurs that the otherwise effective insulation of a wood structure is largely eliminated by the use of guys that shunt the pole.

A discharge to the guy frequently reduces what would otherwise be very effective insulation. More insulation in the guy will remedy this for the most part. Long wood insulators or strain insulators of high insulating value would easily double the effective arcing potential for many installations. It naturally follows that where a line having wood structures is subject to lightning, great care should be given to the insulation in the guy or to its location. It frequently happens that four sections of a suspension insulator placed in the guy will give results that could not be accomplished by utilizing twelve sections divided between the three phases.

Limitations of Wood

Wood structures may be given a high degree of reliability, if care is exercised in the design of structure and selection and treatment of material. Some of the earliest lines were of wood and are still in operation. As mechanical loads increase, the use of wood becomes more difficult, particularly where long spans are necessary.

With reliable insulators the spans may be reduced and advantage taken of the lower effective height to keep down stresses due to lightning. The short span has other advantages, as the conductors may be run with closer clearance, which tends to reduce the bound charge, im-

**Abstract of a paper on "Transmission Line Insulation" presented before the International High-Tension Congress, Paris. The first part of Mr. Austin's paper appeared in* Electrical World *under date of December 24, 1927.*

prove regulation, greatly lowers the cost of the structure and reduces the capacity of synchronous condensers. Although the corona losses are increased with closer spacing, most important lines have conductors large enough to permit much closer spacing.

Where the insulation of the structure or an insulated section in a steel tower can be utilized with a charging wire, much closer clearances are possible. This closer spacing can be utilized to advantage, as the bound charge may be reduced by an appreciable amount. Although the closer spacing necessitates more structures, the lower mechanical duty readily permits insulation in the structure that may easily double the effective arcing potential for the system. This lower effective height is even more beneficial for steel than for wood. Where the conductors are nearer together, the ground wire is more effective, a condition that must not be lost sight of.

String length in itself is not such an important factor where the effective height of the conductors is not increased, except as to the cost of the structures. In the vertical arrangement of conductors for two circuit lines, however, increased spacing due to greater string length necessitates not only a rapidly increasing cost for structures but results in much higher potentials under lightning for which it may not be possible to compensate fully.

The use of a cathode ray oscillograph of the Braun tube type is effective and one was used in making a determination of the effect of string length upon induced potential when the towers are increased in size. As the lower conductor was maintained at the same effective height in all cases, the length of span does not enter into the relative values.

It will be noted in the Dec. 24 installment of this article that the induced potentials rise very rapidly with the increased spacing and height of conductor, indicating that the problem of providing effective insulation against flashover becomes exceedingly difficult with increasing heights.

The passing of laws that necessitate abnormal clearances should be avoided, as the reliability of the line may be seriously affected in going to an increased ground clearance.

In conclusion, it may be said that both wood and steel have their fields, but it is essential that we realize the limitations and advantages in each.

It is believed that the tendency of the future will be to use lower structures, as the cost for structures and insulators for the same reliability for lightning conditions will be less. There are many factors that have important economic advantages that more than offset the saving due to long spans and few structures. These advantages are particularly important where greatest reliability is needed.

With a clearer knowledge of the functioning of the ground or earth wire it will be possible to apply it to advantage in some instances and recognize its limitations in others.

Where ground resistances are high, it is possible that a combination of counter-potential and ground wires might be used to advantage. This applies particularly to exposed conditions on the line where abnormal trouble exists.

Where steel towers are used, it is essential that not only the effect of height and clearances be given the most careful consideration but the effect of the design of the tower upon the electrostatic field be also consid-

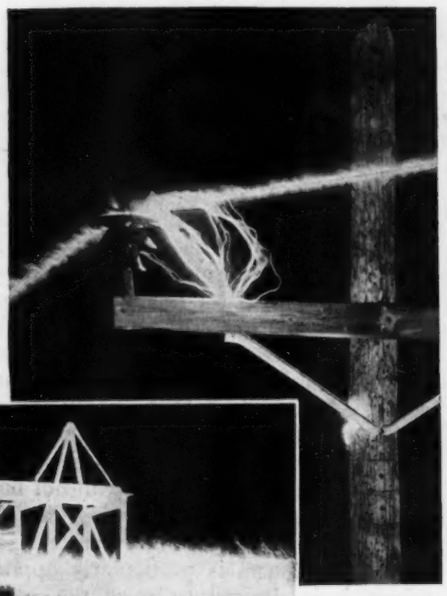


Fig. 1—Insulator mounted on wood pin. Ground lead on opposite side of pole from brace, but not connected to same. Arc strikes from conductor to brace and from brace to down lead at 400-kv. peak, 70,000 cycles. Test shows that wood insulation adds over 140 kv.

Fig. 2—Insulator mounted on steel pin, down lead on pole, but not grounded on brace or arm. Discharge takes place from conductor to down lead at distance of 48 in. at 600-kv. peak, 70,000 cycles. Test shows advantage of making use of full insulation of arm.

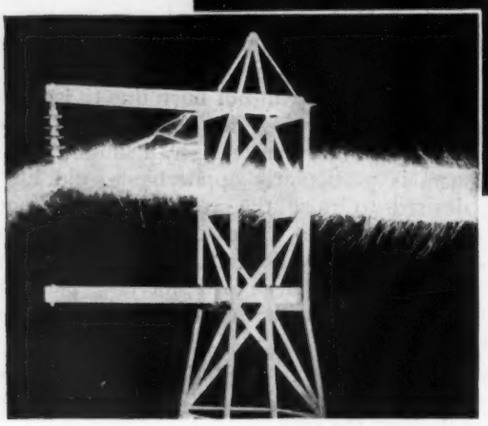


Fig. 3—Five units with insulated control. Tower equipped with wood arms. Arc striking from conductor to tower basket at 645-kv. peak, 70,000 cycles.

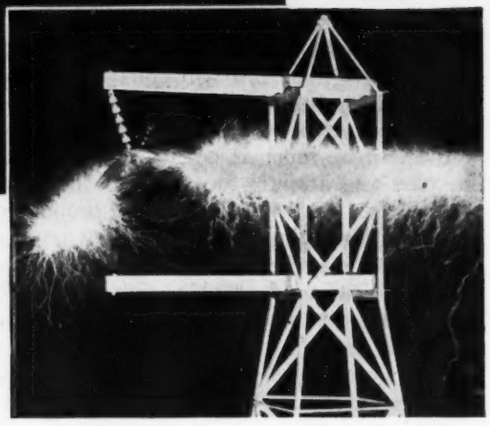


Fig. 4—Five-section insulator with insulated controls and conductor cages. Tower equipped with wood arms. Combination withstanding stress of 755-kv. peak, 70,000 cycles.

FIGS. 1, 2, 3 AND 4—SOME EVIDENCES OF THE INSULATING VALUE OF WOOD

ered, as this field affects the arcing potential. As little effective installation work has been carried out in this connection, it is difficult to predict the possibility where it receives attention.

Since the life or maintenance of wood structures is a factor in many localities, preserving methods should receive more careful consideration. If the insulating value is fully credited, it will be found that more expense is warranted in the treatment. This is particularly true where an untreated core results in a conducting path that will permit shattering of the pole unless thoroughly protected by shunting gap or a lightning rod. A treatment that is satisfactory to one kind of wood may leave a core that will rot out in a few years with another kind of wood. First cost should not be the only consideration, but rather the results obtained.

When the relative electrical performance is credited in designing or selecting the structure, many types that appear costly are really the cheapest in the end and the most reliable. This applies with even more force to a steel tower line, as a wood line frequently has compensating factors as to height due to the insulation furnished by the greater length of the wood.

The effect of shunting or eliminating the insulation of the wood in an H frame structure may be shown by experiment. It will be seen that no electrical advantage is obtained in the case of the grounded wood structure over that of the steel tower. The results indicate that there are other factors that enter into the problem and tend to increase the discharge. Although a horn may lower the flashover but little for a very steep wave, it may cause a discharge at a lower value where the wave has a rather slow rate of decay. In order to make use of relative arc-over values, it is desirable to convert these into the relative number of arcs to ground for the system.

Reducing Distribution Losses

FIFTH ARTICLE

By J. B. Moorhouse
Electric Distribution Engineer
Central Illinois Public Service Company, Springfield, Ill.

Losses From Grounds

AN APPRECIABLE percentage of unaccounted-for losses in distribution may be traced to grounds. Grounds on low-voltage transmission lines and primary feeders are the most serious. However, they are easily detected in most cases. Short circuits and low-resistance grounds in distribution primaries immediately blow fuses or cause circuit breakers to operate. It is usually an easy matter to sectionalize, locate the faulty feeder and proceed with a physical inspection until the fault is discovered. A high-resistance ground on a primary may cause no interruption to service, but if allowed to remain on the line will cause a heavy loss. The presence of tree grounds is excusable only where difficulty is encountered in obtaining permission to trim the trees. Defective lightning arresters, cutouts and insulators are less easy to detect by physical inspection. It is probable that in the past the preceding examples of defective equipment have passed unnoticed for years at a time. Complaints of interference with radio reception have brought about the use of various forms of trouble and interference detectors. Results are already gratifying to radio enthusiasts and have reduced unaccounted-for losses by an appreciable percentage.

Secondary grounds also represent a serious loss problem. Radio sets are less affected by the lower-voltage circuits, inasmuch as the radius of interference radiation is much less. Current leaks through ground to the grounded neutral of a secondary system have little effect on radio sets except where the ground is intermittent or of variable resistance. Little guidance can be expected from radio complaints. Ground-return telephone circuits, however, are seriously affected. Complaints from this source may be expected at once. However, there are few telephone companies operating grounded circuits, except in the smaller towns.

To facilitate the detection of secondary grounds a magnetic ground current detector is useful. This instrument consists of a telephone receiver and a coil supplied with a U-shaped iron core. By placing the coil core

LISTENING FOR CURRENT FLOW ON A DISTRIBUTION NEUTRAL GROUND CONNECTION

around the neutral ground wire of a three-wire secondary, the presence and relative intensity of ground current are indicated by the hum in the receiver. This operation may be performed in a few seconds without cutting and resplicing the ground wire, as would be required if an ammeter were used. Having found a secondary system that shows the presence of a ground, it is sometimes necessary to cut off service drops, one at a time, in order to locate the ground. The magnetic ground detector is also useful in tracing grounds in conduit wiring. The section of conduit carrying ground current will register a hum in the detector phone up to the point of the actual ground.

Cases have been found where the neutral of a three-wire distribution secondary was grounded at one pole and one of the line wires was grounded at another pole. The energy loss from one case of this kind was calculated to amount to more than $100 per year, valuing energy at 1 cent per kilowatt-hour. Using the ground current detector, one man may easily check all the lightning arrester grounds and distribution secondary grounds in a town of 5,000 people in one day.

Mica Proves Value as Supplementary Insulator

By L. B. Schmerber
Material and Process Engineer Westinghouse Electric & Manufacturing Company

IN ORDER to compare the life of insulating materials at various temperatures, a series of extensive tests was carried out by the Westinghouse Electric & Manufacturing Company, covering a period of more than two years. As a result of these tests and from experience gained from machines in service, it is concluded that armature insulation consisting of organic insulating materials, such as cotton, paper, silk, etc., impregnated or immersed in oil, is greatly improved by the use of mica on conductors, and mica wrappers for ground insulation. It takes much higher temperatures than those encountered in rotating electrical apparatus to affect mica. Treated fabrics are satisfactory for insulation in places where temperatures are not excessive and the probability of damage from outside disturbances is slight.

In conducting these experiments, two 15 hp. 220-volt, two-phase squirrel cage induction motors were set up and belted together, one running as a motor and the other as a generator. The desired temperature in the stator winding was obtained by loading the generator of the set. Space heaters were installed for additional heat when required. The temperature was maintained within two or three degrees above or below the specified temperature by means of a thermostat in the surrounding air, which controlled a motor-operated switch in the load circuit. Thus, the load was cut on or off as the temperature demanded. The temperature of the stator windings was measured by means of thermocouples embedded therein. The whole outfit was enclosed in a suitable housing which contained doors for ventilating purposes.

TABLE I—COMPARATIVE FIGURES FOR MICA AND CLOTH AS SUPPLEMENTARY INSULATORS

Run No.	Insulation Slot Portions	Diamonds	Temperature Deg. C.	Winding Failed After, hours
1	Mica wrapper	Treated fabric tape	150	100
2	Mica wrapper	Treated fabric tape	125	4,000
3	Treated cloth wrapper	Treated fabric tape	125	460
4	Treated cloth wrapper	Treated fabric tape	115	940
5	Treated cloth wrapper	Treated fabric tape	105	1,200

As a means of speeding up the tests, the machines were run under conditions of severe vibration, and the windings were given a high potential ground test every 24 hours while they were hot. The conditions of vibration were accomplished by mounting the machines on heavy coil springs and unbalancing the rotors by means of weights attached near the outer circumference. Stops were placed under the slide-rails so that the machines were not permitted to swing freely but were stopped suddenly at each cycle and the nature of the vibration thereby became a severe shock. The high potential test applied each 24 hours was set at two-thirds of the voltage required to break down the winding when new. At the conclusion of each run the machines were stripped, re-wound and overhauled for the next run. Five runs were completed as outlined in the accompanying table. In runs numbers 1 and 2, the ground insulation on the straight parts of the coils consisted of wrappers of 1½ turns of fishpaper and mica, while in runs numbers 3, 4 and 5 it consisted of 1½ turns of varnish-treated cloth. The thickness of the mica wrapper used was 0.012 in., and of the treated fabric 0.010 in. After break-down each winding was examined carefully.

In the cases where the fabric insulation was used, it was found that the treated fabric wrappers had become hard and brittle and could easily be broken when bent. In the cases with the mica wrappers, only the structural material was affected. The backing paper was dry and brittle and the bond had deteriorated, but the mica itself showed its original structure. The indications were that the effect of continuous heat and vibration on insulation increases rapidly as time goes on. Continuous heating has no serious effect on mica insulation, even though the structural material becomes deteriorated. The results of these tests show that the life of mica-wrapped coils is approximately ten times that of coils using treated cloth wrappers. It is evident that failure of this insulation in service is not due to its dielectric strength being impaired, but rather to mechanical failure caused by some external disturbance.

Anchor Resistance to Uplift

By P. F. Gregg
Keokuk, Iowa

THE graph here shown is of use in the preliminary design of foundations or anchors of various types that must present a definite resistance to uplift. The curves are developed for different radii of circular anchors from the equation:

$$V = \pi h(r^2 + 0.11h^2 + 0.58rh)$$

Although the curves were prepared for circular anchors, they are applicable to square anchors where the length of one side of the square is $1.77r$. For the purpose of illustration, assume that the uplift to be resisted is 22,000 lb. and a concrete anchor is to be used. Ordinary earth weighs about 100 lb. per cubic foot, but to make an allowance for the greater density of the concrete, which is included in the volume read from the curve, it will be better to use 110. The volume required for this example will be 200 cu.ft., which may be obtained in several ways. An anchor with a 4-ft. radius 2 ft. 9 in. deep will serve, whereas an anchor with a 1-ft. radius would have to be placed about 6 ft. 7 in. in the ground. The choice between these extremes depends on local conditions readily determinable by the engineer in charge.

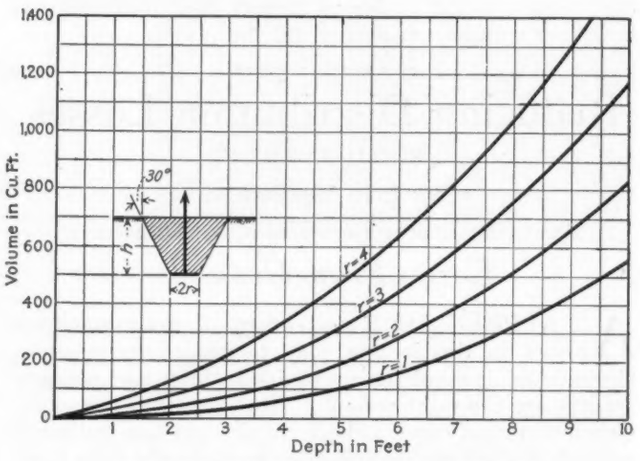


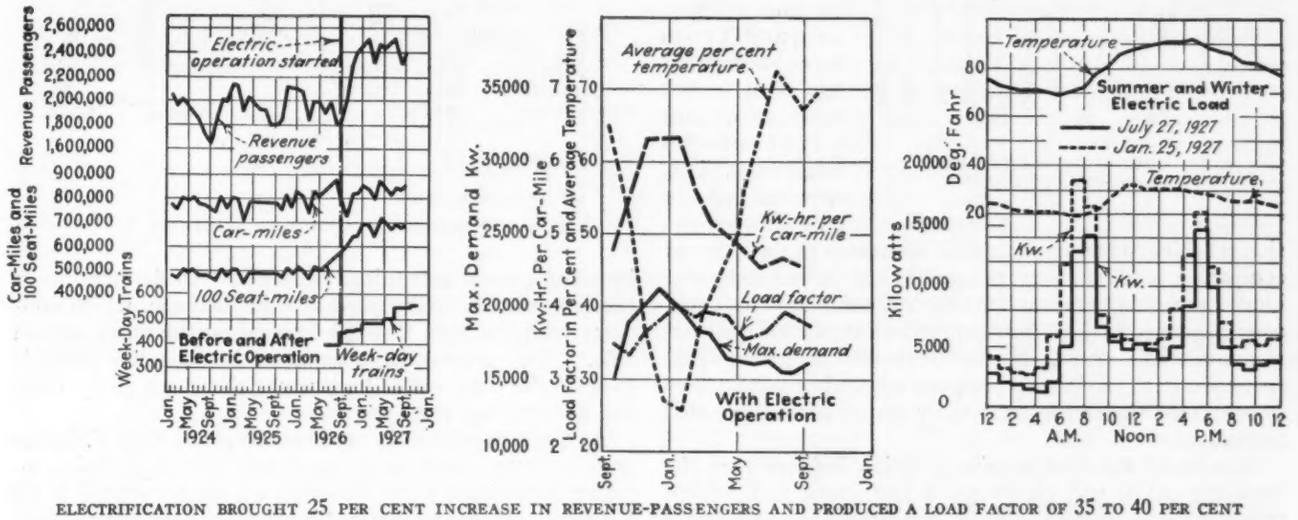
CHART FOR DETERMINING CIRCULAR ANCHORS

Electrification Benefits I.C.R.R.*

Revenue passengers increase 25 per cent.
Running time reduced 11 to 28 per cent.
Four and a half to 6¼ kw.-hr. per car-mile

THE FIRST year of electrified operation of the suburban service of the Illinois Central Railroad out of Chicago has been productive of eminently satisfactory results, according to W. M. Vandersluis, electrical engineer of that railroad. In the year preceding electrification, the steam-operated service resulted in a loss; the indicated profit for 1927 under electric operation is about $530,000. Revenue passengers have increased from about 24,000,000 to about 30,000,000. The number of trains operated has increased from about 400 to 470, not including equipment trains and Chicago, South Shore & South Bend in twenty seconds. After that point the rate of acceleration falls off, but on level tangent tracks a train will reach a speed of 50 miles per hour in two minutes. Although comparatively high braking rates have been accomplished on the steam train, these also have been increased so that electric trains brake at the rate of 1¼ miles per hour per second. It is significant that large decreases have been made in running time, even on runs where more stops are made than formerly.

There has also been a large improvement with electric operation over steam operation from the standpoint of



ELECTRIFICATION BROUGHT 25 PER CENT INCREASE IN REVENUE-PASSENGERS AND PRODUCED A LOAD FACTOR OF 35 TO 40 PER CENT

trains which use the same trackage and terminal. The present total of the electric trains of all classes is 556.

Electric service was put into effect without any serious accidents or interruptions and has so continued during the first year. Due to the fact that all of the motor-trailer car units are uniform in design and in operating characteristics, the preparation of time tables and the handling of equipment at terminal points has been greatly simplified.

Of particular interest is the improvement in running time due to electric operation. The latest electric time table shows decrease in running time over the old steam service of from 11 to 28 per cent of the various classes of trains, the largest percentages resulting in the longer runs. The decrease in over-all time results from high maximum speed and by the use of high accelerating and braking rates. Acceleration is at the rate of 1½ miles per hour per second, which is about six times as rapid as that of through passenger steam trains. Under normal operation a train will reach a speed of 28 miles an hour terminal congestion. This improvement will become of greater importance as the service grows, inasmuch as under steam operation the limit to the number of trains physically possible to move in or out of the Randolph St. terminal was rapidly being approached. This gain is made by the elimination of movements necessary for steam engines in changing ends of trains, and also in being brought from and taken to the engine terminal, since these movements must be made over the tracks serving useful train movement and during the time when track congestion is greatest. The electric train requires only the normal loaded movement over these busy sections, except when brought from or taken to storage tracks at the beginning or end of rush hours.

The results obtained from the motor-trailer combination have been satisfactory. The elimination of all steps on the cars for regular operation (thus requiring high platforms), the use of sliding doors, fully inclosed vestibules, tight lock couplers, automatic acceleration and electro-pneumatic braking have all tended to increase convenience of the passengers and raise safety and speed of operation. The employment of a large amount of aluminum or aluminum alloys in side and roof doors,

*Excerpts from paper presented by W. M. Vandersluis at Great Lakes Regional Convention, American Institute of Electrical Engineers, Chicago.

conduits and fittings has materially reduced the weight of the car and thereby the operating expense.

For the year ended Sept. 1, 1927, the average cost for maintaining the cars has been about 6 cents per car-mile. Delays due to electrical equipment have been very few and no radical changes in design have been found necessary. Minor changes incident to new design have been made but at very slight expense.

For the year the total energy supplied under contract with the Commonwealth Edison Company was 57,274,512 kw.-hr. Of this, 92.7 per cent was for traction purposes, including heating of cars; 6.1 per cent for light and power, and 1.2 per cent for signals. The requirement that the load factor be kept at 30 per cent or above has been fulfilled in good measure.

AFTER ELECTRIFICATION THE ROAD WAS OPERATED PROPERLY

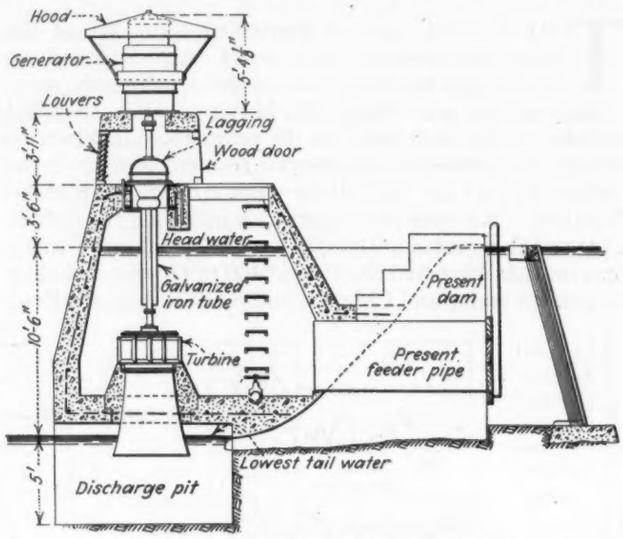
The supply of energy by the power company over specified feeders to the right-of-way line of the railroad company from seven substations has been looked upon in some quarters with misgivings. This requires that not only the conversion machinery but all protective apparatus in the railroad company's feeders be maintained by the power company. Under normal operation the railroad company has taken over the control of all traction feeders by use of a supervisory control system. So far the results have been satisfactory due to the power company's broad-minded policy in operating under the necessarily somewhat complicated agreement.

Results of the first year's operation indicate that the traveling public will gladly use a fast, clean and reliable transportation system. This indication is particularly supported by the great increase in the "off-peak" business, which, of course, is the most satisfactory from the standpoint of profitable operation.

Outdoor Hydro Plant

By Joseph Franz
Engineer Southern Berkshire Power & Electric Company, Stockbridge, Mass.

FROM time to time the advisability of placing generators outdoors has been discussed, but so far as I am aware an installation recently made by this company is the first of its kind. The company had a good concrete dam available 12 ft. in height, which was formerly used for a grist mill and which was acquired to protect the run-off for a downstream plant. Analysis showed that about 150,000 kw.-hr. could be generated in an average year of stream flow and that the most desirable development would be about 30 kw. An 18-in. Leffel, Type Z turbine was placed in a concrete flume with open setting, draft tube, extension shaft and thrust bearing to support the turbine shaft and generator rotor and care for hydraulic thrust. The generator is a three-phase, 60-cycle, 277-r.p.m. General Electric induction machine, delivering energy at 2,300 volts to a neighboring line. It is designed for full runaway speed and is known as the E-frame, side-air discharge type. The insulation is threaded to withstand moisture, but the manufacturer would not guarantee it for outdoor operation in the severe weather of western Massachusetts. For this reason we added a large metal umbrella to keep heavy downpours from entering the top intake and to shed rain and snow from the generator. The side air discharge opening was protected by adding a 4-in. longer petticoat consisting of a galvanized-iron band. The lower air intake holes around the base were also closed



CROSS-SECTION OF OUTDOOR GENERATOR

by putting on a galvanized tin strip. Air is taken in at the bottom through a large hole in the base, which connects with the open through louvers on the down-stream side. This precaution was taken because the plant is close to the dam and at high water there is a spray from the water going over the dam.

As the temperatue is at times 20 to 30 deg. F. below zero and the plant must stand idle for days owing to water conditions, a non-freezing oil must be used in all bearings, otherwise thrust bearings in particular would heat before the oil would warm up sufficiently to circulate between the bearing plates. It was found necessary also to lag the thrust bearing housing to prevent sweating in the space above the oil level. A thermometer was placed here so that the temperature of the oil could be noted.

A single three-pole oil switch with overload protection placed in the space below the generator foundation and housed in, constitutes the only switching equipment. A pole fastened to the outside of the flume carries the wires connecting the generator to the line. Metering equipment at present is placed in the old mill close by, but could be mounted in a cabinet on the pole. The plant is put on the line by opening the gate part way, bringing the generator to approximate speed and then closing in the switch.

If the line voltage fails, the machine runs away at the full turbine speed of 459 r.p.m. at 10½ ft. net head. When the line is energized again, the generator simply pulls into step. There is no danger of overloading the generator, as the turbine output limits the power input. The overload protection is simply to clear the generator in case of generating failure.

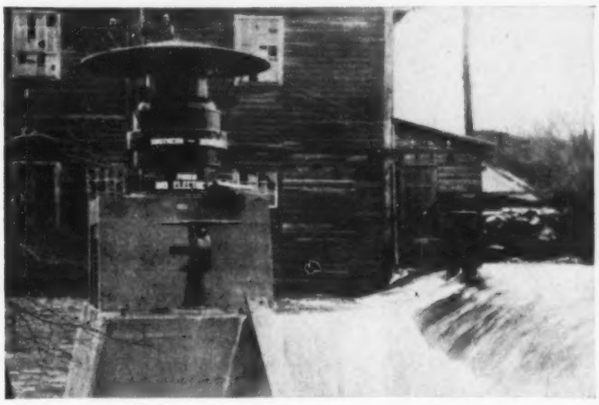
The efficiency of the generator at full load is 84 per

cent and that of the turbine 81 per cent. At 95 per cent load the turbine efficiency is 88.5 per cent.

The generator stood out of doors during a very rainy summer, with no protection whatever. It has been in operation since Nov. 1, 1926. No precautions were taken as to drying out before putting on the line.

The illustration shows the plant defying the worst flood conditions ever experienced in these regions, spray flying continuously for several days over the generator. In addition, rain and sleet were experienced.

Operating costs will not exceed 50 cents per day, with part-time labor cleaning the racks when necessary and oiling every four months.



OUTDOOR UNIT IN OPERATION UNDER FLOOD CONDITIONS

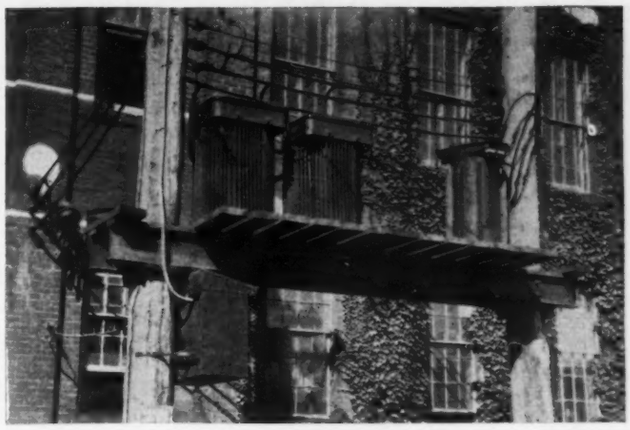
Although this plant is very small, the writer sees no reason why the same thing cannot be carried out on larger types of synchronous machines, eliminating upkeep, insurance and taxes on buildings housing generators. Higher efficiencies due to better cooling of generators would also be of value.

Safety Features for Transformer Mounting

By O. A. Perchway
General Superintendent Fulton Light, Heat & Power Company, Fulton, N. Y.

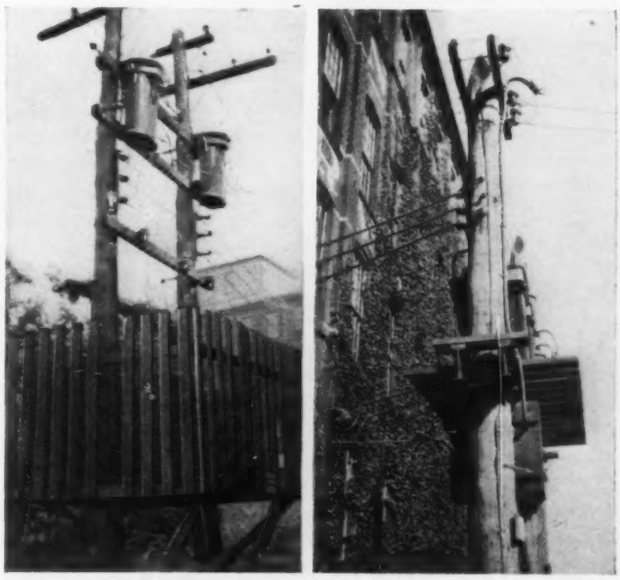
OUTDOOR substations composed of not more than three 100-kva. power and one lighting transformers with pole mounting are used on the system of the Fulton Light, Heat & Power Company. This is the maximum transformer capacity that is allowable in this system on such supports. To secure greater safety for linemen and other operating and maintenance employees, this company has endeavored to improve the type of support generally used for these installations.

The accompanying illustrations indicate an old-style mounting and a new-style one. It will be noticed that the dangerous features involved in the old-style job, where the linemen must climb over the secondary and work in among the primary wires and support himself in precarious ways while doing the job, have been eliminated and that not only is there a bus plan, utilizing ordinary secondary racks, but sufficient width of platform on either side of the transformer casing has been provided to permit both better working conditions and greater safety in this work. The standard practice, as developed, is to place secondary buses on either side of the pole, power on one, lighting on the other. The primary wires are carried between the two lines of secondary and suspended from mid-points of the poles. This eliminates the possibility of the workmen coming in contact with the primary wires in response to an instinctive action to grasp something in the event of a fall or loss of balance. The use of racked secondaries permits a better, safer and neater looking job. When primary metering is used, leads from the line conductors are tapped for the current and potential transformer installations. This prevents primary voltage from entering the customer's premises, as the metering leads from the potential transformers are introduced into the building through a small low-voltage cable.



STANDARD MOUNTING AFFORDS SAFETY, PERMANENCE AND RELIABLE SERVICE

The poles used in such installations are set in concrete, so arranged that water will run off from the base of the pole and so elevated above the level of the ground that moisture cannot remain in contact with the wood for any considerable period. This not only increases the life of the pole but permits the use of more permanent types of construction for the transformer station, as, by using sturdy timbers, the engineers may be sure that it will not be necessary to change the location or reset the transformers except at extremely prolonged intervals.



FORMER AND PRESENT PRACTICE IN TRANSFORMER MOUNTING AT SMALL INDUSTRIAL SUBSTATIONS
Instrument transformers included in modern industrial service practice

Operating Employees Stage Lamp Sale

THE results of this Mazda lamp campaign demonstrate what can be accomplished when each member of our organization puts his shoulder to the wheel and tries earnestly and sincerely to co-operate in selling merchandise. It is very gratifying to every official of our company to have actual proof of the latent merchandising ability of our operating employees and of their willingness to use that ability. It is exceptionally gratifying to have observed the interest taken by the heads of the various operating departments and to have noted, not only the enthusiasm with which they imbued their own organization, but, as well, the harmony and co-operation which they brought about between their own and other organizations in their territories.—J. W. BUSCH, *Assistant Vice-President.*

EMPLOYEES of the North American Light & Power Company subsidiaries in Illinois, Iowa, Missouri and Kansas recently completed a 30-day lamp sales campaign in which 365,452 lamps were sold, or 114 per cent more than the quota. A great deal of latent sales ability was uncovered among operating men.

The objects of the employees' campaign, as mapped out by J. W. Busch, assistant vice-president of the Illinois Power & Light Corporation, were as follows: first, to co-ordinate the sales efforts of individual companies with the N.E.L.A. campaign to fill all empty sockets; second, to increase the proportion of 60-watt lamps, thereby selling customers more light, which is advantageous to the customer as well as to the company; third, to initiate a new policy of obtaining the sales effort and assistance of operating employees who may be counted on as a big factor in future merchandising activities. The plan provided that, while local commercial departments supervised and assisted in carrying out the campaign, commissions and prizes were paid only to employees of other than the merchandising and commercial departments.

Results were produced strictly by concerted selling efforts. Lamps were sold only at regular prices and no special inducements were offered. Arrangements were made with lamp manufacturers to supply advertising folders and window trims, the use of such material being left to the judgment of the merchandising manager of each property, and newspaper advertising was held to regular schedules.

Quotas were set for each district based on the sale of one lamp for each meter installed. The companies' properties are divided into eight natural geographic groups or divisions, each of which constituted a unit in conducting the campaign. Commissions were paid to employees on lamp sales and district prizes were awarded to the different divisions for making their quota.

Commissions were designed to encourage the sale of lamps in carton quantities and in wattages of 60 or more. The schedule was as follows:

Carton quantities (6) 60-watt and over, 25 cents per carton
Carton quantities (6) 50-watt and over, 20 cents per carton
Less than carton quantities, 100-watt, 5 cents each
Less than carton quantities, 60-watt, 3 cents each
Less than carton quantities under 60-watt, 2 cents each

In addition to the cash commission, prizes were awarded to the various districts in amounts not to exced 4 per cent of the total sales in each group. These district prizes were distributed to employees in addition to their commission on lamp sales at the close of the campaign. Each district organized its individual sales program, the principal feature being to enlist the active interest of the operating employees. In this respect the plan was highly successful, as a list of the prize-winning employees includes the names of linemen, meter readers, gas fitters, cashiers, storekeepers, etc. A colored truck driver was well up among the winners.

Another feature of the campaign was a special booklet issued in the Kansas group to every employee, setting forth the purposes of the campaign, acquainting the employees with the quotas, and including a price list on the regular lamp stock.

The Iowa group led all others in the competition, selling 79,890 lamps, 150 per cent of its quota. Kansas Power & Light was next with 4,135 lamps—136 per cent. The Central Illinois group was third with 91,401 lamps—135.4 per cent. The other divisions ranked as follows: Western, 115.5 per cent; United Power & Light, 109.1 per cent; Missouri, 91.8 per cent; Southern, 74.7 per cent; Northern, 71.7 per cent.

In addition to the actual sale of 365,452 lamps, Mr. Busch enumerated the following definite and tangible results from the employees' campaign: (1) Increased wattage of lamps used by customers, (2) stimulated the company's own lamp business, (3) stimulated the lamp business of other dealers in the territories served by the various groups; (4) taught the company the value of aggressive selling; (5) taught customers to buy lamps in cartons; (6) brought about excellent relations between the commercial department and operating employees of the local properties; (7) uncovered much good sales timber among employees of the operating department and (8) increased and enhanced cordial relations between units of each group of properties.

Street-Lighting Construction Costs at La Grange, Ill.

UNIT and extended prices covering the installation, less lamps, of the new street-lighting system at LaGrange, Ill., are given in the accompanying tabulation. LaGrange is a village of about 9,000 population in the Chicago metropolitan district. The installation includes 113 lamp-bracket arms and 34 concrete posts; 2,500-lumen lamps are used.

COST OF STREET-LIGHTING INSTALLATION AT LAGRANGE, ILL

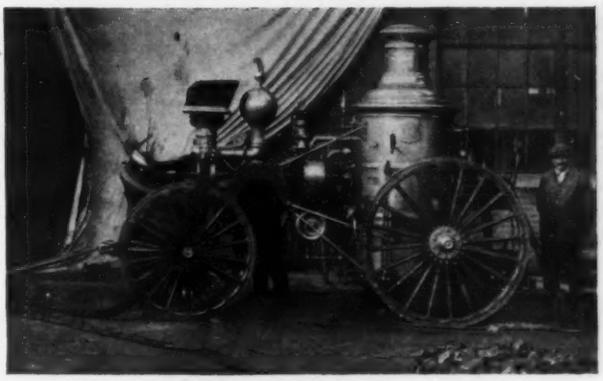
Item	Unit Price	Extension
1. 13,200 ft. trench	$0.03	$396.00
2. 1,390 ft. 2½-in. pipe	0.80	1,112.00
3. 40 ft. 2½-in. street crossing	0.80	32.00
4. 300 ft. 2½-in. railroad crossing	0.80	240.00
5. 4,200 ft. sidewalk	0.15	630.00
6. 122 hand holes for single transformer	8.70	1,061.40
7. Three hand holes for plural transformers	72.00	216.00
8. 16,500 ft. 5,000-volt cable	0.24½	4,042.50
9. 10,000 ft. 2,500-volt cable	0.16	1,600.00
10. 4,000 ft. twin conductor cable	0.22½	900.00
11. Two transformers	63.51	127.02
12. 113 transformers, illumination, 250 cp	31.75	3,597.75
13. One 4-kva. transformer	135.00	135.00
14. Two 5-kva. standard transformer	594.00	1,188.00
15. One three-pole time switch	124.00	124.00
16. 113 17-ft. post brackets	90.50	10,226.50
17. 147 post holes	3.15	463.05
18. 34 16-ft. concrete standards	90.50	3,077.00
19. Two cedar poles	35.00	70.00
		$29,138.62

Restoring Service After Flood

Generating plants dried out by emergency heating equipment. Mechanical injuries to apparatus more serious than soaking

By F. P. Wilson
Manager Contract Service Department, General Electric Company, Schenectady, N. Y.

WHEN the waters of the recent flood had broken over Vermont, New Hampshire and western Massachusetts, telephone, telegraph and messenger calls for help in restoring electric service poured in to the offices of the General Electric Company. Experienced and resourceful electrical repairmen were ordered into the field to get "on the job" with all possible speed and to remain until service was restored. Extraordinary difficulties were overcome in reaching the operating companies' territories, owing to the destruction of usual lines of transportation, bridges, railroads, etc., in the flood zones. To get around the head waters of the Connecticut River two men had to drive to Montreal; others had to drive 50 miles up a river to reach a town visible from the starting point. Communication was badly interrupted, and in many cases it was impossible to determine either the exact location or the extent of equipment damage before visiting the properties in the field.



STATION BUSES BEING PROTECTED FROM WATER BY FIRE DEPARTMENT PUMP

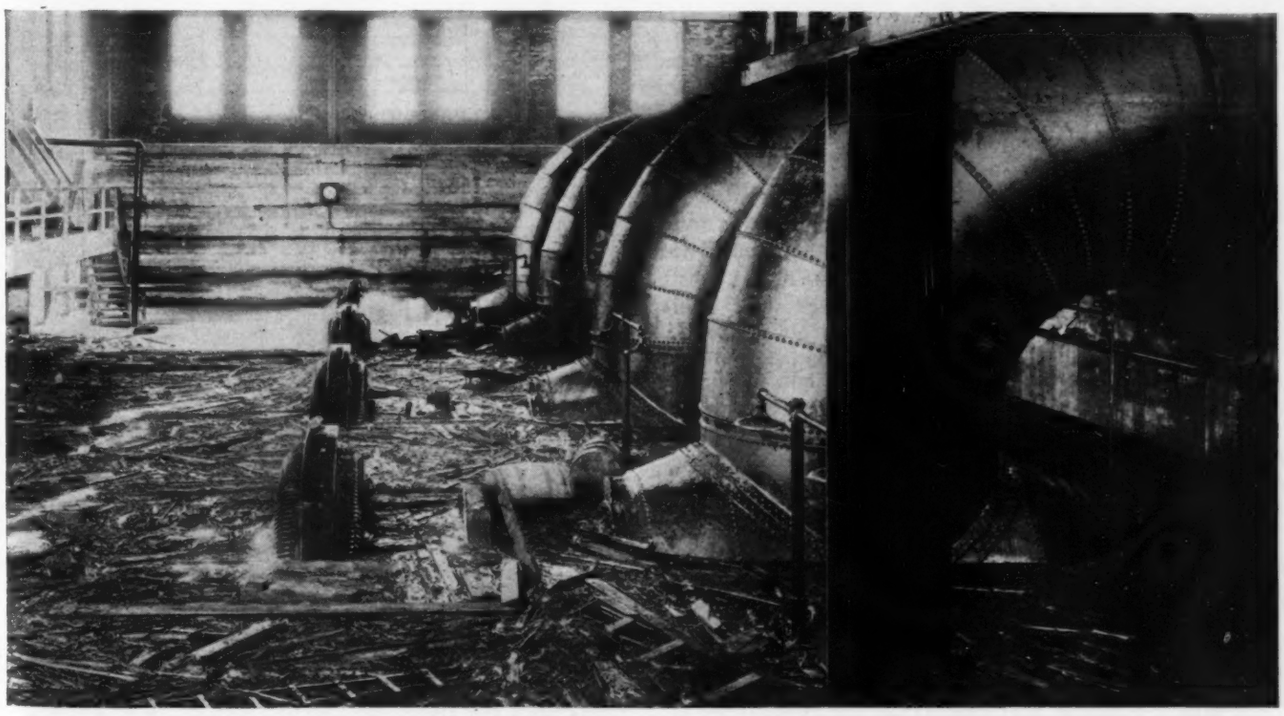
General Instructions for Servicing

The following general instructions were given field men:

"Generators and exciters will be wet and clogged with mud and débris. Use a fire hose and thoroughly wash the windings. Clean the bearings and fill them with new oil. Get the machine turning over so that the water will be thrown off and the windings partly dried by windage. Make full use of available local facilities. Heated air must be circulated through the windings to dry them. Steam radiators, hot-air furnaces, stoves with sheet-iron jackets, and head-light heaters can be utilized. Stovepipes heated on their outer surface with plumbers' furnaces will give a current of warm air if fans are used, or the natural draft will suffice if no other way can be found. Temporary baffles of sheet iron, wallboard or canvas will serve to direct the warm air, in order to evaporate and to carry off the moisture. Covering a machine with blankets or tarpaulins and then heating it will cook the insulation but will not dry it.

"Do not use coal, coke, charcoal or wood fires for drying. The use of such fuel will result in depositing soot, ashes and sulphur on the windings and will destroy the insulation. Open fires may be used to heat air in pipes, etc., but be sure the smoke does not come into contact with the windings."

Moisture frequently collects underneath exciter commutator bars. To remedy this trouble some of the clamp bolts were removed and small port-hole ventilating scoops of tin were inserted in alternate holes and pointed in the direction of rotation, so that air was forced beneath the commutator bars by the scoops and out through the holes in which scoops had not been placed. The air circulation,

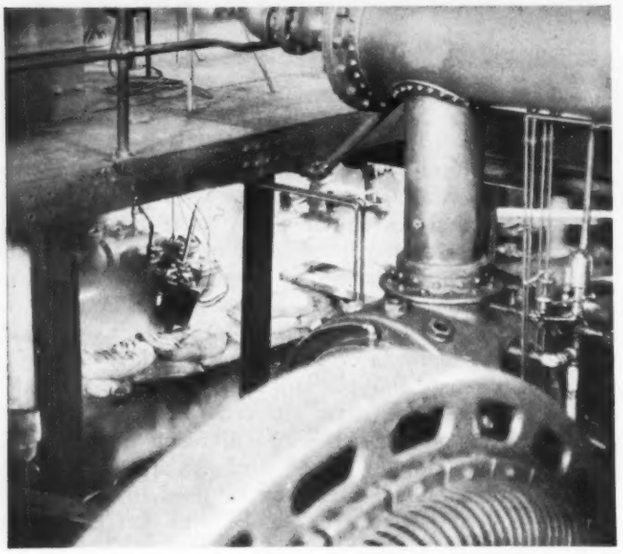


DÉBRIS LEFT BY FLOOD IN GENERATING STATION
High water almost reached the tops of the intake penstocks in Essex station, near Burlington, Vt.

added to the external heat, quickly dried the commutator.

In most cases the equipment was simply submerged and covered with silt and trash. In a few of the hydro-electric plants the penstock gates had been jammed with débris, making it impossible to shut down the turbine before the water flooded the station. Some of the generators ran from 36 to 48 hours submerged Fortunately the operators had cut off excitation before the generators were flooded.

In one hospital the lighting and heating plants were



BOILER-FEED PUMP OPERATING BELOW WATER LEVEL
Forty-two inches of water held out by sandbag barrier in steam plant of Pittsfield Works, General Electric Company.

put out of service. Hundreds of tons of driftwood piled against the walls of the building and it finally collapsed. The switchboard was salvaged from the wreckage, and although it controlled direct-current apparatus, the service man managed to change it over for temporary alternating-current service so that power from a neighboring central station could be used and the buildings lighted. When the engine-driven direct-current generators of this plant were unearthed from the débris, the chief trouble was found to be water damage. The commutators had trapped water. The air-scoop method was employed and electric heaters were used to dry the pole windings of the generators. An alternating-current motor was found and the motors of the hospital ventilating equipment were dried by belting the alternating-current motor to the laundry drier. In 24 hours the buildings were lighted and in four days heating and power service was resumed.

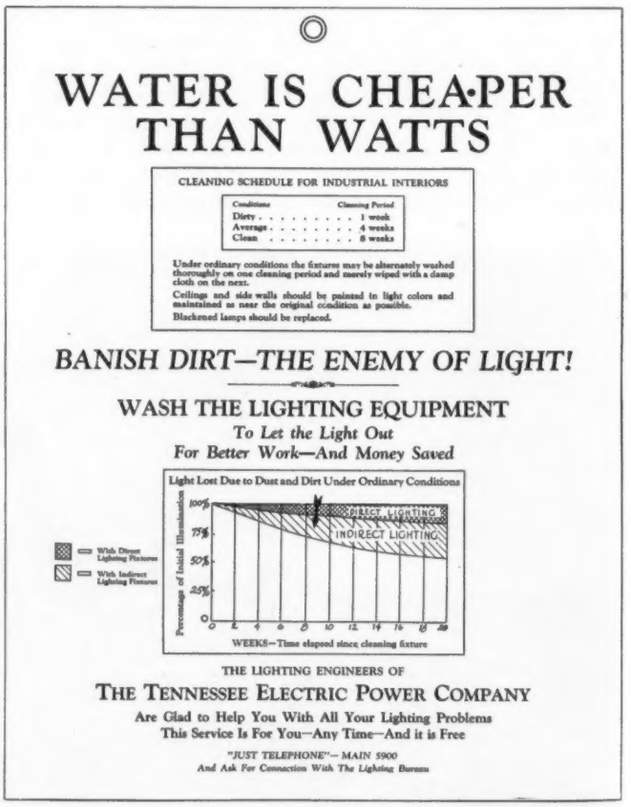
Stoves, electric heaters and fans proved invaluable for drying out the equipment. Electric power was available in many of the stricken sections. In only a few cases was it necessary to dry out switchboards and transformers. In some stations the operators had effectively stuffed the wiring conduits with rags and waste. In general, the same methods were used for drying the switchboards as were employed for the rotating equipments. Temporary ovens, made of Celotex, wallboard or wood, with heaters or stoves to maintain a temperature of from 80 to 100 deg. C., were used for ventilating and drying instrument transformers and for some of the distribution transformers. Cable ducts were flushed with clean water, and where draining was ineffective, compressed air was employed to remove the water and dry out the ducts. Hot air was then forced through the ducts. Continual requests for switchboards, generators, transformers and other parts poured in. These were shipped by truck, by automobile and by personal baggage. The proper drying methods were telephoned or telegraphed to customers.

The damage by water soaking was not serious, but some of the machines that were damaged by floating objects will need replacing. An interesting sidelight was the discovery of a number of "old-timers" that have been in continual operation for 30 years or more. Some of these were in need of repair or had to be replaced solely because of the flood damage.

In emergencies such as this utilities and industrial plants cannot do much preventive work, nor can people in sections never before flooded expect to work out extensive plans for repairing damage. One of the most important lessons of such a flood, however, is the necessity of doing everything possible to keep water out of buildings. If it is possible to remove exciters to places of safety before the flood waters rise, this equipment will always prove of material help in later drying out water-soaked apparatus.

Promoting Industrial Lighting

ONE method of promoting good industrial lighting, used by the Tennessee Electric Power Company, is to place placards such as the one shown in the various plants served. This particular placard tells of the advantage of clean fixtures, glassware and bulbs. The loss


WATER IS CHEAPER THAN WATTS
CLEANING SCHEDULE FOR INDUSTRIAL INTERIORS
Conditions
Cleaning Period
Dirty . . . . . 1 week
Average . . . . . 4 weeks
Clean . . . . . 8 weeks
Under ordinary conditions the fixtures may be alternately washed thoroughly on one cleaning period and merely wiped with a damp cloth on the next.
Ceilings and side walls should be painted in light colors and maintained as near the original condition as possible.
Blackened lamps should be replaced.
BANISH DIRT—THE ENEMY OF LIGHT!
WASH THE LIGHTING EQUIPMENT
To Let the Light Out
For Better Work—And Money Saved
Light Lost Due to Dust and Dirt Under Ordinary Conditions
DIRECT LIGHTING
INDIRECT LIGHTING
With Direct Lighting Fixtures
With Indirect Lighting Fixtures
Percentage of Initial Illumination
100%
75%
50%
25%
0
0 2 4 6 8 10 12 14 16 18 20
WEEKS—Time elapsed since cleaning fixture
THE LIGHTING ENGINEERS OF
THE TENNESSEE ELECTRIC POWER COMPANY
Are Glad to Help You With All Your Lighting Problems
This Service Is For You—Any Time—And it is Free
"JUST TELEPHONE"—MAIN 5900
And Ask For Connection With The Lighting Bureau

PLACARD USED BY THE TENNESSEE ELECTRIC POWER COMPANY TO PROMOTE INDUSTRIAL LIGHTING

in illumination due to dirt plotted against elapsed time since last cleaning is graphically shown. The placard ends with the statement that the power company is glad to furnish its facilities to solve lighting problems.

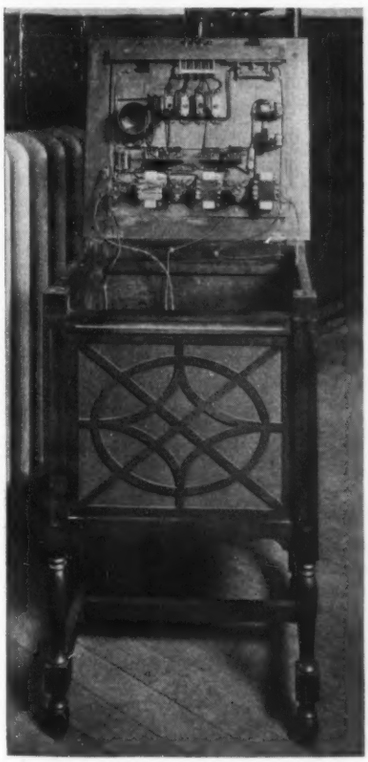
Choice of Programs Over Telephone Circuits

Three carrier waves afford as many programs with 50-watt source. Self-contained receiving unit. Fourteen hundred subscribers in one city

By George R. Eaton
Chief Engineer Kellogg Switchboard & Supply Company, Chicago, Ill.

"PROGRAM SERVICE" is an outgrowth of furnishing programs over the telephone wires to to subscribers. Such "wired programs" have been in more or less successful operation for several years. In fact, they have become sufficiently important to warrant the banding together of telephone companies into the National Program Service Association. So far the systems in use supply programs at audio frequencies over special telephone circuits. This service is supplied to as many as 1,400 subscribers in one city.

Telephone cables do not lend themselves readily to the transmission of the necessarily broad band of frequencies required in supplying high-grade musical programs. This condition exists because these cables were designed and built for voice frequencies, which cover a considerably narrower band of frequencies than that required for program service. It has been found that only two subscribers can be supplied satisfactorily on a cable pair and the output voltage to this particular circuit must be below a certain value of resultant "cross-talk" will be experienced. The higher frequencies that must be handled in program service "cross-talk" more readily than the highest frequencies encountered in ordinary telephone work. Cross-talk, therefore, limits the voltage that may safely be applied to the program-service circuits and makes it necessary to use high-capacity rather than high-voltage amplifiers. As a result it is necessary to use a large number of amplifiers. The Kellogg Switchboard & Supply Company early experimented with this type of program service, and its engineers felt that these programs, if furnished over telephone circuits, should be applied at other than audio frequencies. About this time Major-Gen. George O. Squier invented an arrangement making possible the use of high frequencies for supplying programs over telephone circuits and applied for a patent thereon. This principle has been experimented with on electric-light circuits. To investigate and determine the possibilities of supplying program service at other than audio frequencies an experimental station was started in the plant of the Stephenson County Telephone Company, Freeport, Ill., with George X. Cannon as general manager. The following assumptions were made and had to be verified by experimental tests, as it was impossible to make any except very general calculations.



PROGRAM-SERVICE SUPPLY UNITS

PICK-UP OR RECEIVING SET USED AT TELEPHONE SUBSCRIBERS' PREMISES

It was believed that it would be possible to find a band of frequencies over which a number of programs could be simultaneously distributed to all cable pairs in the telephone plant through the capacity between pairs in the cable. In other words, it was proposed to excite a cable pair with a group of programs from suitable apparatus, these programs to be distributed to all other cable pairs through the capacity of the cable. The capacity of the cable being known, it was possible to calculate approximately the most efficient band under ideal conditions. In the average telephone plant these ideal conditions do not exist.

A large percentage of the cable pairs in the plant may be directly connected to ground. The cable sheath may or may not be grounded. Losses through common grounded groups, such as the returns on common-battery line circuits, can be made negligible by inserting impedances of low resistance in these common grounds, if high frequencies be employed for program distribution. Investigation showed that, if a large group of line circuits were connected to ground on one side, barriers were necessary. In the entire group of experiments this was the only change that was required to be made on any telephone equipment, and in this particular instance it consisted of five impedance coils.

It was possible to obtain satisfactory reception at the subscriber's end of any one of the 5,400 cable pairs at the experimental station by means of a simple detector and two-stage amplifier when 22 pairs were excited from a single 50-watt program supply unit. The sensitivity of the pick-up device, of course, determines the size of the program supply unit.

The system that was finally placed in operation consisted of a studio, or other means for supplying programs, from which programs are carried into the central office over cable parts at audio frequencies. To convey the three programs without distortion, it was necessary

to balance or equalize these pairs. Three program-supply units are installed at the central office, together with the necessary amplifier and modulating systems. The triple unit is connected to the required cable pairs, which serve as an antenna system, and to the ground for return. At the subscriber's station is a cabinet containing a loud speaker and the pick-up device. This consists of a detector and two-stage amplifier, using alternating current tubes and a "B" supply device. Four connections are required: two for supplying the set with 110 volts, 60 cycles current; one to one side of the telephone circuit, and one connected to ground. The connection to the telephone circuit is made through less than 100 micro-microfarads capacity, so that losses to the telephone circuit are negligible.

An off-and-on switch is provided for operating or disconnecting the set, three push buttons for selecting one of the three programs, and a volume control. The energy is supplied at such a level that it is possible to secure any volume that may be desired by the subscribers with the receiver conrtols furnished.

Street-Lighting Under Central Management

City secured 33 per cent increase in illumination and company 15 per cent increase in income, besides 32 per cent on new investment

AN INTERESTING example of the value of holding company service in street-lighting negotiations is afforded in a city called Spragueville. This is a combined industrial city and suburb of a larger community, and has a population of about 24,000, the total area being 15 square miles and the length of streets 90 miles. Under lone-hand management the street lighting was entirely direct current, with a white way system of about 120 luminous arcs, about 120 pendant type 900-cp. magnetite arcs indiscriminately scattered through the town, a few 200-cp. Type B and 100-cp. Type B and about 1,000 40-cp. Type B incandescent lamps.

A conference with the city lighting committee revealed that the city authorities were dissatisfied with the street illumination for several reasons: outage and electrode sticking of pendant arcs; scattered distribution of lamp designs; lack of consistency in placing lamps; and a per capita cost of about $2.30 per annum.

The making of a new street-lighting contract was turned over to the commercial department of the management corporation that had recently acquired control of the utility. It was found that under the old lone-hand régime the detailed records were either missing or so poorly prepared that the original cost of the equipment could not be obtained. There was no recorded street-lighting layout and there were no maps of the underground system furnishing lights in the urban center. Overhead system records were incomplete. The holding company engineers estimated the original cost of the street-lighting system by their knowledge of prices at the time of its installation and by reference to the records of a neighboring company under this management which had installed an ornamental system at about the same time as Spragueville. It was found that the revenue from street lighting returned the company only 7.5 per cent for interest, depreciation, taxes and insurance upon the estimated original investment. The city favored changing over to alternating-current street-lighting service, but was anxious not to increase materially its outlay for this purpose.

The commercial department of the holding company made a thorough study of the situation and recommended revamping the system, installing a few additional white way units, lighting the main state highway with 1,000-cp. incandescent lamps located on every third pole, and tapering the illumination on the main highways to neighboring towns from 1,000-cp. down to 250-cp. lamps. It was also advised that 400-cp. lamps be used on certain important corners, 250-cp. lamps on others and so on, with lesser illumination on intermediate sections and at less important intersections. The use of Type B lamps was recommended to be discontinued. An engineering investigation by the holding company recommended concentrating the whiteway service on two direct-current circuits and changing over to alternating-current service on the rest of the lighting. An extended study was also made of lamp prices to bring these to values that would be consistent with prices in near-by cities and not too radical a departure from the old contract prices.

The recommendations and a new five-year contract were submitted to the city authorities. As a result of the good relations of the utility manager with the city officials and the latter's confidence in the utility and the management corporation, the recommendations were accepted by the city with practically no opposition. The city gained a 33 per cent increase in illumination, 379,100 cp. vs. 285,720 cp., on a contract price that increased but 15 per cent, or from $54,948 to $63,476. The company made a net saving of $2,500 by the change to alternating-current service, and this, added to the gross revenue gain of $9,320, yielded a total of 32 per cent on the new investment of $36,900 required to modernize the illumination.

The mutually satisfactory result was due to a number of factors, chief among which was that the whole situation was handled by the commercial department of the management company, which had a definite plan of procedure that was followed under the best of relations with the city authorities.

Community Responsibilities of Utilities Increasing

WE FEEL that we are outgrowing the status of a mere vender of a commodity and take satisfaction in being looked upon as a force to be used in the upbuilding of our respective communities and their industries. It is very little satisfaction if our contacts are limited to the rendering of a monthly bill for the power delivered, but it is well worthwhile if our industries will look to us for engineering assistance in their particular problems of power and heat application. And now to be called upon to work with those interested in varied lines of endeavor such as agriculture, commerce, etc., in a larger sphere of usefulness makes us realize that we have responsibilities of a larger nature than we had heretofore recognized.

—From an address by SAMUEL FERGUSON *at the Third New England Conference.*

Short Customer Campaigns
Secure Best Results

By Percy H. Whiting
President P. H. Whiting & Company, Inc.

CUSTOMER ownership, with more than a decade of successful operation behind it, has settled down, in the electric industry, largely to a matter of routine. Only a few problems remain, notably:

1. Where should you charge the cost of reselling your securities (and if you charge it to the cost of *selling* where are you going to charge it when you *stop selling*)?

2. What does it actually cost to sell customer-ownership securities—and how can we hope for any really intelligent comparative figures until we have a standard stock-selling cost accounting?

3. Is it cheapest and best to sell to customer through employees through regular salesmen or through both.

4. If you sell through employees, is it bettter to sell in short, sharp campaigns or through long-drawn-out-drives?

Any one of the first three questions is good for a mild verbal battle whenever customer-ownership men gather together. But question 4 is the one that is always calculated to start a real ruction whenever two men get together who take opposite sides.

When the writer answered this question years ago to his own entire satisfaction, he went into the experiment without any preconceived notions—in fact, he did not even know that there was going to be an argument. In conducting this experiment he tried campaigns varying in length from one day to one year—nearly 150 campaigns in all. After this rather comprehensive experiment, his mature opinion, that has not been shaken either by experience or by argument (and he has had about equal parts of both) is that the best results come from a short, sharp employee campaign—usually ten days.

His reason for favoring the short campaign, against one which is spread out through many weeks or even through several months, are as follows:

1. A short campaign results in more shares sold.

Securities are sold by employees largely on enthusiasm. Linemen and meter readers aren't salesmen. They can be stirred to heights of enthusiasm that will enable them to sell more effectively than trained salesmen, but no living force can keep up this enthusiasm for a longer period than ten days or two weeks, and once enthusiasm has faded, it will not bloom again under six months.

If you ask employees to enter into a four months' campaign, they feel that they are being asked to become salesmen and to neglect their regular work. However, they can be convinced that it is no hardship on them to make two or three calls a day for ten days. They know that their chance for making money is limited and they go after it.

Customers, on their part, are told that the sale will last only ten days and hence are more eager to buy than they would be if the stock could be secured any time they were ready to buy it.

2. A short campaign causes less interference with operating efficiency.

Years of experience have proved that a well-managed and loyal organization can both handle routine operating matters and sell stock. This is easily proved by asking those who have tried it.

In a long-drawn-out campaign employees are likely to ask for time off to make calls, most of which they never make. They get disgruntled because week after week and month after month they are hounded to sell stock. If they are finally persuaded to go into selling, they are likely to do so at the neglect of their regular work.

A short campaign is a game, a long campaign is a grind.

3. Short, sharp campaigns are likely to result in the better placement of securities.

In a short campaign the investor will learn that he must buy promptly or lose his chance. He will buy because he wants to, because he considers it an opportunity rather than because somebody begged him to.

Experience shows that in a long campaign a few employees get interested in stock selling, develop some real sales ability and generally end in selling in comparatively large blocks. In a short campaign, under the stimulus of the tremendous enthusiasm that can be built up, it is not infrequent for from 75 to 95 per cent of all employees to sell. To accomplish this they make many small sales to the very kind of people the executives of the company are most anxious to reach—and incidentally the people most likely to hold the stock after they buy it.

4. Stock is sold in short campaigns at a lower cost.

It is possible, when selling in ten-day campaigns, to prepare a budget of costs that will be miraculously accurate. Theoretically this should be possible in a long campaign, but practically it does not seem to be.

In a short campaign one good strong advertising cam-

Some of the Advantages of Short Campaigns Are:

Result in larger sales
Interfere less with operating efficiency
Likely to produce better placement of securities
Result in lower selling costs
Facilitate maintenance of secondary market
Have better effect on public relations

paign (newspaper and direct mail) will furnish all the background needed. To keep up the enthusiasm of employees and customers through a long campaign by advertising would be prohibitively expensive.

It is not necessary to build up a large, permanent, trained customer-ownership supervising organization for short campaigns. Many companies find it cheaper to employ outside organizations to supervise their sales. Such organizations can handle campaigns expertly and at small expense.

5. The secondary (or resale) market is more easily maintained when short campaigns are used.

The best way to keep your market cleaned up is to keep a waiting list of people who want to buy your security. Then, when somebody comes to you who wants to get his money out, you pass the word along to employees, they see the people on the waiting list and the stock is gone. In a long campaign it is difficult to build up a waiting list. Customers find that they can get stock practically whenever they want it, and hence they don't want it. When they learn that a short sale has ended and their chance is gone, being human, they want to buy and naturally get on the waiting list.

6. Short campaigns have a better effect on public relations.

A company that conducts long-winded campaigns leaves the public with this undesirable impression, "We are always wanting money, are always hounding you for it." In the short campaign, people are not "begged" to buy, they are "given an opportunity" to buy, which has a decidedly different effect on their feelings.

Then, too, in a short campaign, more calls are made on the kind of people who should learn about your company and its partnership, whether they buy or not. In other words, the campaign becomes a greater machine for spreading propaganda, just exactly where you want it spread.

All of which is argument, and never convinced anybody. But here is what will convince anybody who will make the experiment: If you believe in long sales, conduct a good long one, the longer the better. Keep a careful record of cost, sales, etc. Then, after a decent interval, say six months, have a ten-day sale. Give it a fair chance, of course; have it set up and supervised by people who know how to supervise short campaigns. Educate your employees with a series of brief meetings about the company and its security and how to sell it. Give them a simple manual and make them study it. Do some intelligent advertising—and plenty of it. (Six or eight newspaper insertions and two direct-by-mail pieces are about right.) Next set up machinery so that every employee in the company will make twenty or more calls in the ten days of the sale. Then touch it off, step back and watch them sell.

The results will convince you where my arguments have probably failed.

Are Blueprints Accompanying Quotations the Buyer's Property?

MANUFACTURERS sometimes refer to the use by buyers of blueprints embodying design and submitted as part of a quotation. Buyers sometimes use the design submitted by seller A and asks seller B to lay out his apparatus in accordance with that design; perhaps he will award the contract to seller B because his apparatus is preferred or the delivery terms are better or for some other reason, but at the same time use the engineering talent of A without recompensing him for it.

A prominent buyer, when asked to analyze this situation, said that an equitable method of handling the problem and one that has been proposed is for every manufacturer to make a charge for furnishing a quotation, but he doubts if this condition would ever be reached by American industry. On the other hand, he pointed out that in effect the manufacturer now gets paid for such quotations, as they are a part of overhead charged on every job and on the average the percentage of business obtained compared with the total business quoted on is about the same for all manufacturers as compared on a basis of percentage of overhead. As far as using the engineering design of one manufacturer without recompensing him for it, the buyer said that this was done for the good of the industry as a whole and that no one manufacturer had a monopoly on engineering design, so that this would happen as much in one case as in another. The buyer also pointed out that where a manufacturer had a good engineering design it was a part of his job to convince the buyer that he should use his apparatus with his design.

There seems no likelihood of any change in this situation. Fundamentally, this buyer believes it was a part of our American industrial growth and was responsible among other things for our rapid progress. He cited as a parallel the freedom with which the ideas of individual American manufacturers frequently become the property of the industry and said the use of a design submitted by a manufacturer as part of a quotation was actually in the same class.

Venetian Design Street-Lighting Post

THE city of Beverly Hills, Calif., recently placed in operation an ornamental street-lighting system on Wilshire Boulevard, using a post with Venetian lantern effect as shown in the accompanying illustration. The lantern, which is 4 ft. 6 in. high, is designed for a single 25,000-lumen lamp. The posts are 24 ft. overall, with the light center 21 ft. 6 in. above the street. In all, 243 posts, spaced approximately 115 ft. apart, were installed. A row of blue gum trees has been planted between the posts. For three years the trees will be below the lights; for three years the foliage will interfere with the light; after that the foliage will be above the light-center.

Relative Weight of Factors Influencing Public*

VIEWS of 27 utility executives in Illinois on "Public Relations" were solicited recently by letter and 23 responded with comprehensive replies. The letter requested two types of response: First: an offhand statement of what the term "Public Relations" connoted in their minds when it was mentioned; second: considered judgment as to the relative importance of 23 items urged by one or another expert as necessary means to better public relations.

Among the various interpretations of public relations one reply, in particular, described the term very clearly. It read: "My idea of desirable public relations is the relation enjoyed by the keeper of the country store or the local druggist or grocer in the city or community, whose integrity, common sense, good intentions and kindliness are believed in and respected by all." To fourteen out of those replying, the first picture of public relations includes good physical service in some form or another. For example, "Above all things, the actual service you render to the public must be first class." Employees figure in the offhand pictures too: "If our service is good, if the employees are cordial, pleasant and accommodating, open and frank in all their dealings with the customers, honorable and true men and women, I have no fears whatsoever as to how the public will feel toward the operating company."

The considered opinions on the factors entering into good public relations are best presented by the tabulated analyses. To simplify the presentation of the opinions expressed, a single vote has been given each correspondent on each element. Where the vote is recorded as indicating major importance in creating favorable public relations, it is understood this means that the item can be so handled as to secure this result, whereas if improperly treated, an effect of similar weight in unfavorable public relations will follow. Even with this simplified method of indicating judgment, however, it is still necessary to preserve both the favorable and unfavorable rating columns, as on one or two items individual votes ranging from major weight on the favorable side to average weight on the unfavorable side were recorded.

The striking unanimity of opinion as to the weight that should be given certain elements in comparison with the wide divergence of opinion on others appears even in casual inspection. Thus, on Physical Service and Appearance of Structures, all votes were cast in two columns. Employee Performance, Telephone Service, Adjustment of Criticism, Good-Will Advertising, Co-operation with Educational Institutions, Organization Membership, show

*Abstracted from paper presented at Illinois Utilities Convention, Springfield, Ill., by William A. Durgin, director of public relations, Commonwealth Edison Company, Chicago, Ill.

TABLE I—RELATIVE IMPORTANCE OF DIFFERENT FACTORS IN PRODUCING FAVORABLE PUBLIC RELATIONS, BASED ON VOTES MADE BY 23 KEY MEN IN ILLINOIS

	Major	Large	Average	Slight	Negligible
Physical Service:					
Continuity, pressure, adequacy and availability of current supply, etc.	18	5	..	..	..
Service Connections:					
Promptness, liberality of extension policy, etc.	4	12	6	1	..
Appearance of Structures:					
Way in which grounds and buildings are maintained, character of overhead construction, individual service connections, etc.	..	9	14	..	..
Financial Stability:					
Business standing of enterprise as it affects the attitude of the public	2	8	9	4	..
Customer Ownership:					
Wide local distribution of securities	3	11	8	1	..
Local Management:					
As distinguished from holding company or outside control	2	8	4	7	2
Employee Performance:					
Technical expertness, interest in customer, knowledge of business, clarity of statements, courtesy, appearance and speech	16	6	1	..	..
Telephone Service:					
Promptness, voice, accuracy, completeness	3	15	5	..	..
Correspondence Service:					
Promptness, clarity, courtesy, accuracy, adequacy	3	9	10	1	..
Adjustment of Criticism:					
Handling of complaints, compliments and requests for special service	7	14	2	..	..
Rates:					
(a) In relation to other commodities in the community	2	6	8	6	1
(b) In relation to similar rates in other communities	2	6	10	4	1
*Gratuitous Service:**					
Free lamp renewals, free replacement of fuses, free consultation on wiring, illumination, application of motors, etc.	..	1	10	9	1
Merchandising:					
Electrical appliances, supplies and accessories	..	2	12	7	2
Good-will Advertising:					
Inserts with bills, newspaper statements of policies, national magazine ads similar to the American Bell Telephone campaign, etc.	..	2	18	3	..
Public Speaking:					
Addresses on phases of the business to various civic groups—clubs, churches, schools, etc.	1	7	15	..	..
Co-operation with Educational Institutions:					
Furnishing of lecturers, employment of graduates and during vacations, of professors and instructors as well, and supplying material for sound text books and other educational uses	..	8	12	3	..
Organization Membership:					
Individual membership in chambers of commerce, noon-day clubs and various public, civic and country club organizations	..	9	13	1	..
Commission Regulations:†					
Control of franchises, financing, rates and service by governmental body	2	3	11	1	4
Hostile Propaganda‡					
Newspaper, periodical, political, etc.	..	..	..	..	..
Education of Legislature§					
Supply of accurate information on public utility problems	1	4	12	3	2
Past History of Enterprise:					
Performance and alliances of predecessor companies or present company in earlier stages	..	7	7	5	4
*Complete Frankness***					
On policy, on financial standing, on methods and on privileges to customers	6	13	4	1	..

* Two blanks recorded average importance in creating unfavorable public relations.

† Two reports indicated commission regulation as slight or average importance in producing ill will.

‡ Eleven out of 22 declared hostile propaganda a large factor in producing ill will, the remainder being about equally divided in ascribing slight or average importance to it.

§ One vote was recorded against educating the legislature on grounds that ie tends to produce public ill will.

** One double vote was recorded against complete frankness, it being claimed at major factor in creating ill will.

an almost equal agreement of opinion. On the other hand, the estimates of the importance of Local Management and Rates are widely divergent, and those of the two political elements, Commission Regulation and Education of Legislature, scatter so much in the fringe votes as to make any inspectional summary somewhat indefinite as to conclusions.

The only practicable method of getting some single indication of state-wide opinion on such elements seems to be through the conversion of these divergent ratings into percentage terms. After consultation with a number of individuals, arbitrary figures were assigned as follows: Major, 95 per cent; large, 75 per cent; average, 50 per cent; slight, 20 per cent; negligible, 0. Applying these figures to the number of votes cast in each column and dividing by the total number of replies on each subject, a final relative percentage rating of the elements was secured. No claim for any refined precision is made for these arbitrary figures, but, as will be seen in Table II, certain groups of elements are so sharply separated from others that a reasonable variation in the percentage values assigned would have little effect on the relative order of importance.

TABLE II—RELATIVE IMPORTANCE OF 23 FACTORS IN PUBLIC RELATIONS

Factor*	Importance	Per Cent Rating	No. of "First Impressions"
Physical service	Major	91	14
Employee performance	Major	86	15
Adjustment of criticism	Large	79	
Complete frankness	Large	77	2
Telephone service	Large	72	
Service connections	Large	70	2
Customer ownership	Large	66	
Correspondence	Large	64	
Appearance of structures	Average	60	1
Public speaking	Average	60	8
Organization membership	Average	59	
Hostile propaganda	Average	58	1
Financial stability	Average	57	2
Co-operation with Educational Institutions	Average	55	
Rates (b)	Average	53	7
Rates (a)	Average	50	7
Local management	Average	49	
Good-will advertising	Average	48	7
Education of legislature	Below Average	44	
Past history of enterprise	Below Average	42	
Commission regulations	Below Average	40	
Merchandising	Below Average	39	
Gratuitous service	Slight	34	

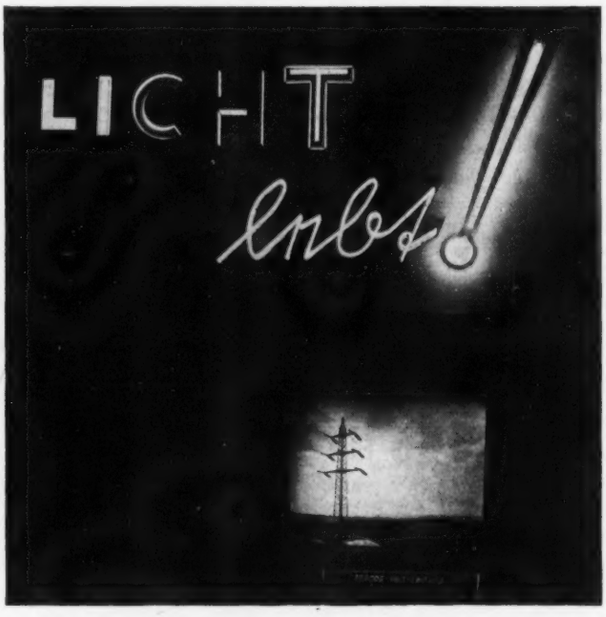
* For definition, see Table I.

Meeting Industry Needs or Selling Against A Competitor

SOME salesmen persist in selling against a competitor rather than in selling their product to meet the needs of the particular industry being served. This inevitably leads to price cutting, and manufacture degenerates into a feat as to who can hold out longest on the thinning bar of profits. This condition is partly aided by some company executives who stoutly proclaim one policy and just as quickly weaken under slight pressure and accept price-cutting business. The resort of the salesman to certain tactics of unfavorable comparisons with competitive equipment frequently becomes odious and some salesmen go as far as even to write such evidence of unfair selling, which more than once finally reaches the hands of the very competitor in question. While this condition exists it is difficult to bring the manufacturers together and elevate the selling plane. It must first be rooted out if we are to progress. This elevation of selling principles is of importance to the buyer, who not only is seeking the lowest price commensurate with quality but is looking farther toward the development of the products which he must constantly buy.

Another method sometimes pursued by salesmen after the order is lost is to discredit the financial condition of the company receiving the order, especially where that company is small, and to try to plant in the buyer's mind the germ of suspicion that before the apparatus is delivered the seller may reach a financial condition that would delay delivery. This is not a relic of the past, as only within the last month a salesman, hearing that a small company had received an order which he was also trying to obtain, went to the buyer and began to cast reflection on the financial condition of the manufacturer receiving the order. Fortunately in this case the buyer was particularly well informed as to the financial condition of the electrical manufacturer in question and knowing him to be perfectly sound, he was in nowise adversely affected by the attitude of the salesman but rather in his mind there was set up a distinct barrier to this salesman and his product. However, experience has shown that only in too many cases has a salesman been able to set up a doubt in the buyer's mind which required considerable work to remove. These methods seldom get the salesman or his company anything but a negative reaction, and far better results would be obtained if the product were sold on its merits and the industry were sold on the basis of its needs rather than against the competitor. Less business will be taken at low prices when this becomes the rule rather than what might almost be called the exception under present conditions.

Relative Values of Electric Sign Letters Demonstrated



AN EFFECTIVE method of demonstrating electric sign letters of various types is shown, the letters being mounted in a darkened space in the office of the Berliner Stadtische Elektricitats Werke Aktien Gesellschaft, of Berlin, Germany, above an illuminated view of a 100-kv. transmission line serving the municipality. The "set-up" emphasizes the vitality of light and includes several types of letter illumination as well as gas-filled tube lighting units.

Employees Average 73 Lamps in 15-Day Campaign

THE sale of nearly three incandescent lamps per meter by the winning company, an average of well over one lamp per meter throughout the entire territory, and the sale of 3,966 lamps by one salesman were among the features of an incandescent lamp sales campaign held for fifteen days during October by eight member companies of the Mohawk Hudson Power Corporation.

The campaign was one of the most successful of recent lamp-sales drives on a basis both of total sales and of quota realized. The results showed the distribution of 61,157 kits, or 366,942 lamps, with a retail value just short of $100,000—$98,464.77 to be exact—with a merchandising profit of almost $10,000 above all expenses, not to mention the increased load represented by the lamps.

Household kits containing six inside-frosted Edison Mazda lamps—one 100-watt, three 60-watt and two 40-watt lamps—were sold by employees of the eight competing companies at $1.61 per kit, the standard price for the lamps individually. The coupon books, method of payment, employee bonus and features of the campaign as used by the Syracuse Lighting Company were reported on page 1043, of the Nov. 19 issue of ELECTRICAL WORLD. It is estimated that there were at least 10,000 salesmen, a majority of the 5,000 employees having had one or more assistants among their friends and relatives. Prizes were offered by each of the competing companies for those who sold the greatest number of kits, as well as for those company departments that made the best percentage showings on their quotas. In addition to these prizes offered by the individual companies, the Mohawk Hudson Power Corporation offered a plaque to the winning company and $100 in gold to the key man of that company's campaign organization.

Factors in Successful Lamp Campaign

Employee-salesmen received adequate instructions as to sales methods and product offered.

Sales interest maintained at a maximum by prompt release of daily results and by campaign news sheets.

Organized support of workers by newspaper advertising, window displays, bannered trucks, etc.

Competitive efforts among individuals, departments, and companies.

Not a single company failed to surpass the figures that had been set for it. The Cohoes Power & Light Corporation, winner of the contest, sold 288 per cent of its quota. The Mohawk-Hudson group made 139 per cent of its allotted sales. One hundred and seven salesmen—including three women—become members of the 100 Kit Club, receiving recognition certificates as well as bonuses or additional prizes. The record sales were 661 and 475 kits by the leader and runner-up, respectively.

When a lamp sales campaign was proposed, the Argus Company of Albany was called into consultation. The plans for the campaign were made by that company, with the assistance of representatives of the Edison Lamp Works and subject to the approval of the Mohawk Hudson Power Corporation. Each of the companies appointed a key man for the work. Sales promotional literature of two kinds was prepared by the advertising company. The first included the material for stimulating the interest of the salesmen and, since all employees were to be salesmen, this literature was distributed to all. The second type of material, to stimulate the interest of the public in the campaign, included newspaper advertisements, window displays, truck banners and signs, small stickers for correspondence, etc.

RESIDENTIAL APPEAL IN UTILITY DISPLAY AIDS LAMP SALES

A series of meetings at the headquarters of the eight member companies, at which company executives, supplemented by lamp-company men and field representatives of the advertising company, outlined to the prospective salesmen the methods recommended for the campaign. Each salesman was given an eight-page booklet containing numerous sales suggestions, and a number of small ten-page order books bearing the legend "This book is worth $2.50 to me in cash."

Throughout the campaign daily reports were forwarded to the Argus Company, showing the number of kits sold in the 24 hours ending at noon. Each night a chart was printed, showing that day's sales for all companies and the total sales to date, as well as thermometer-type statistics on percentages of quotas realized by each company. These charts were posted on company bulletin boards on the following morning. On five occasions during the campaign "Kit Call" was distributed to all employees. This broadside, or news sheet, contained personal notes regarding the sales activities, pictures of the leading salesmen and interesting window displays, statistics of the campaign and articles featuring sales hints.

High-Voltage Testing Laboratory for Germany

A NEW high-voltage testing laboratory has recently been installed at the works of the Hermsdorf-Schomburg Insulator Company, at Hermsdorf. The plant is capable of developing a potential of 500,000 volts. but this will probably be extended later to 1,000,000 volts. It comprises a number of 800-kva. transformers fed by 5,000-volt alternators driven by 315-kva. asynchronous motors with synchronous auxiliary motors.

Letters from Our Readers

Comments on Water Heater Experience

To the Editor of the ELECTRICAL WORLD:

Publication of the article "Electric Water Heating on the Pacific Coast" in the ELECTRICAL WORLD for Nov. 19 should serve a real purpose because it gives concrete facts and figures based on experience in contrast to some of the very theoretical statements being made regarding electric water heating practice. May I offer the following comments on some of the discussions regarding observations of the Coast installations.

The article states: "The principal objection to the low-wattage heater has been that it requires a low energy rate on account of high radiation losses to keep the customer's bill down to the point where water heating service can be sold." I think the writer has missed the point that high radiation losses are not necessarily inherent in a low-wattage storage heater. In fact, with carefully insulated tanks the radiation loss need not exceed 10 per cent of the total energy consumption. However, a large share of the greater kilowatt-hour consumption by the customer with a low-wattage flat-rate heater compared with one using a high-wattage intermittent heater is accounted for by the more liberal use of hot water by a family having continuous hot-water service available. In other words, a family using an intermittent system automatically restricts its hot-water consumption to the amount that it is willing to pay. Because of the slow rate of heating, low-wattage heaters are suitable only for continuous service. Companies favoring low-wattage heaters, on either flat or metered rates, find it necessary to establish a very low rate (generally not in excess of 1½ cents per kw.-hr.) to permit water heating service being sold to the small customer.

Your writer has not mentioned the growing tendency toward the use of complete storage-tank units to provide a more efficient installation than the usual outside circulation or side-arm type heaters. We, and other manufacturers, are finding an increasing demand for the complete tank units because:

1. It permits the dealer or central station to make a sale of a complete article and eliminates the necessity of purchasing the tank from one source, the heater from another, the insulation from a third, and then paying the local rates of labor for the installation job.

(2) The most important advantage is the substantial reduction in heat loss. The installation of outside circulation heaters on 30-gal. tanks, where the heater or tank is poorly insulated or piping is not properly installed, has a loss of 300 to 400 watts when used continuously. This loss can be reduced to 75-150 watts with a well built tank heater. This saving justifies the investment in the complete unit, especially for the user who utilizes continuous service.

The use of low-loss tanks and carefully insulated piping will permit central stations to sell domestic hot-water service satisfactorily at rates that would be prohibitive if inefficient uninsulated tanks and heaters were used.

F. H. MCCORMICK,
Engineer.
Range & Water Heater Division,
Edison Electric Appliance Co., Inc.,
Chicago, Ill.

Removing Errors from Short-Circuit Tests

To the Editor of the ELECTRICAL WORLD:

The article on "Removing Errors from Short-Circuit Tests" by C. L. Kasson of the Boston Edison Company in the Oct. 29 issue of the ELECTRICAL WORLD is of rather timely interest. In this connection the writer desires to call attention to the rulings of the A.I.E.E. Standardization Rules: "The interrupting rating of an oil circuit breaker is a rating based on the highest r.m.s. current at normal voltage the breaker can interrupt under the operating duty specified. The current taken shall be that existing during the first half cycle of arc between the contacts during the opening stroke."

At the midwinter convention of the A.I.E.E., following the presentation of the paper on "Tests on Oil Circuit Breakers" by Sporn and St. Clair, J. B. MacNeill referred to "the average test voltage [so-called in the paper]; that is, the system voltage *prior* to the short-circuit." It was the writer's privilege recently to witness a number of short-circuit tests on oil circuit breakers, and later he was called upon to write a report on these tests. At the time he advocated that the interrupted kva. be figured from simultaneous readings during the time of the arc determined from oscillograms which were available, but he was overruled, the decision being that the A.I.E.E. standards should be followed. Consequently, it was interesting to hear the same thing proposed by an official of a prominent public utility company.

At the A.I.E.E. midwinter convention considerable emphasis was placed upon sticking to test facts, yet the interrupting kva. was based on values of voltage and current that were not coexistent. In the 1927 annual report of the A.I.E.E. sub-committee on oil circuit breakers it is stated: "In the matter of standards certain changes have been recommended and are now under consideration by the standards committee in Standards Nos. 19 and 20." The subject raised by Mr. Kasson appears worthy of consideration by the committee in making out their revised standards.

A. NAETER,
Associate Professor of Electrical Engineering.
Michigan State College,
East Lansing, Mich.

Warns Against Unauthorized Use of Name "Edison"

To the Editor of the ELECTRICAL WORLD:

At the recent annual meeting of the Association of Edison Illuminating Companies held at Colorado Springs, Colo., at which were represented virtually all of the electric light and power companies holding original franchise rights from the old parent company—the Edison Electric Light Company—attention was called to a number of cases where new companies or combinations of companies in the public utility field are being organized using the name of "Edison" in their corporate title without proper authority.

An arrangement has been made by the Association of Edison Illuminating Companies under which such companies as make use of the name of "Edison" without proper authority are referred to Thomas A. Edison for such action by him as may seem indicated in each individual case to prohibit the improper and unauthorized use of his name in connection with electric light and power enterprises.

PRESTON S. MILLAR,
Secretary Association of Edison Illuminating Companies.
New York, N. Y.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Some Factors in Furnace Design for High Capacity.—E. G. BAILEY.—The principal factors influencing furnace design are stated as being: complete combustion with a minimum of excess air; controllable rate of combustion over a reasonable range; long endurance of furnace walls; prevention of slag on boiler tubes; and removal of ash. The difficulties encountered in early furnace practice are stated in relation to the solutions which have been found expedient for present day practices. Test data are given for a number of representative installations. The author states that complete combustion requires temperature, turbulence and time and that a reduction in the value of any of these items may be counteracted by an increase in one or both of the others. He states that to burn a given quantity of fuel and keep each particle of fuel within the furnace a relatively long time requires a large furnace. As large furnaces are expensive, therefore it is desirable to reduce the time factor. Turbulence, he stated, as being best accomplished by violently mixing the proper portions of fuel and air immediately upon entering into the furnace and continuing the turbulent mixing action throughout the furnace. Attention is called to the desirability of maintaining the ash in pulverized-coal-fired furnaces at a temperature lower than the melting point of the ash and of installing water-cooling tubes so that ample circulation will be provided and exposure of the vertical tubes to excessive flame temperatures can be avoided.—*Mechanical Engineering,* December, 1927.

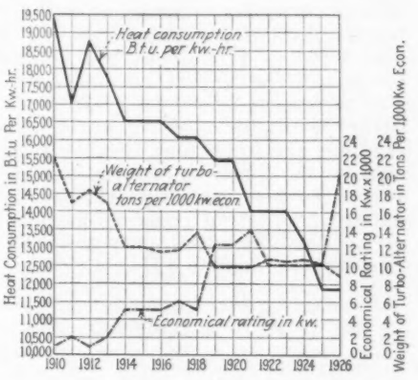
Units, Measurements and Instruments

Electric Measurement of Mechanical Actions.—D. I. SACHSENBERG.—The fact that high-frequency oscillatory circuits are very sensitive to the slightest change in the capacity of the circuit is utilized in this new apparatus to measure with a high degree of accuracy the minutest mechanical variations. A specially designed and constructed condenser of the size of a match box may be fastened to the cutting tool on a lathe, connected to an oscillatory circuit, and a photographic record made of the frequency. The latter is accomplished by a simplified oscillograph in which a strip of bromide paper is unrolled from a drum. The result is a continuous sequence of closely drawn black lines the length of which fluctuates in direct proportion to the stress upon the cutting tool. In a similar way boring mills, planers, bending stress on beams, or any other mechanical stresses, can be analyzed. Among the chief advantages of this new method is its high degree of sensitivity and the absence of inertia in the transmission from the object to the remote recorder.—*Zeitschrift des Vereines Deutscher Ingenieure,* Nov. 12, 1927.

Generation, Control, Switching and Protection

Developments Under the 1926 Act.—HUGH PATERSON.—A review of the results achieved through the inauguration of the Electricity Act in England. The contemporary engineering advance taking place in that country in equipment design is illustrated by the diagram indicating the development of the 3,000 r.p.m. steam turbo-alternator manufactured by a British concern.

The author appeals for standardiza-


Heat consumption B.t.u. per kw-hr.
Weight of turbo-alternator tons per 1000 kw econ
Economical rating in kw.
Heat Consumption in B.t.u. Per Kw.-hr.
Economical Rating in Kw. x 1000
Weight of Turbo-Alternator in Tons Per 1000 Kw. Econ.
1910 1912 1914 1916 1918 1920 1922 1924 1926

DEVELOPMENT OF TURBO-ALTERNATOR (BRITISH PRACTICE)

tion of both steam pressures and size of units and foresees the installation of larger size units. The "grid" system as developed and amplified in this territory is noted—*The Electrician (England),* Nov. 11, 1927.

Porcelain Leading-Through Insulators.—F. A. DAHLGREN.—The author has considered the problems involved in the use of condenser bushings for leading-through purposes for voltages exceeding 20,000. It is stated that the condenser bushing is a most reliable piece of apparatus which may be easily designed to carry out satisfactorily all the duties of a first class leading-through insulator. The field distribution may be arranged in a most favorable way for securing high, flash-over voltage, as well as great safety against failure by puncturing. The high cost of installation has militated against the universal use of this equipment but the advantages are foreseen as predominating. An analysis of the electrostatic conditions involved in the use of this equipment is offered. It is suggested that flash-over voltage may be raised by arranging cylindrical shields or networks as a continuation of the flange.—*The Electrician (England)* Dec. 2, 1927.

Transmission, Substations and Distribution

Instability in Transformer Banks.—KING E. GOULD.—The instability which sometimes occurs in banks of transformers supplying a capacity load when certain harmonics in the primary current are suppressed, either by the type of transformer connections or by a resonant circuit in series with the primary of the transformer, is considered and the similarity between the several unstable circuits is pointed out. Curves showing the triple-frequency voltage distortion as a function of the capacity load have been included for two of the unstable circuits. Oscillograms taken during the period of instability are shown. An explanation, substantiated by actual analyses, has been brought forward for the simplest unstable circuit, consisting of three branches connected in Y across a three-phase line, with balanced sinusoidal line voltages, and with the neutral unconnected, each branch of the Y consisting of an iron-cored reactance in parallel with its capacity. The explanation is extended to other cases, two with experimental evidence as justification and the third by analysis only.—*Journal of the American Institute of Electrical Engineers,* November, 1927.

Electrophysics, Electrochemistry and Batteries

Density of Electrical Properties of the Systems, Rubber-Sulphur.—H. L. CURTIS, H. T. MCPHERSON, and A. H. SCOTT.—The density and electrical properties of compounds of rubber and sulphur were measured for the range of composition from zero to 33 per cent of sulphur or from crude rubber to hard rubber. Important changes in the properties with the proportion of sulphur were measured. These showed definite regularities, and occurred at compositions which might be represented by simple empirical formulas, and were, accordingly, taken as indicating the existence of definite compounds of rubber and sulphur. At the composition 19 per cent of sulphur, all the properties which had been studied underwent significant changes. It was with this mixture that the curves relating to density and percentage of sulphur show a change in slope, and the curve relating to thermal expansivity to percentage of sulphur, a distinct inflection. Both the dielectric constant and the power factor curves passed through minima at 19 per cent of sulphur, while the resistivity curve took a decided upward trend. The composition of 10.5 per cent of sulphur, was marked by a maximum value of the dielectric constant. The power factor showed a maximum of 13.5 per cent. The maximum of the resistivitv occurred at about 26 per cent of sulphur. No extensive study was made of the effect of

free sulphur on the electrical properties of rubber, but data were obtained which indicated that it was small relative to the effect of the combined element. Dielectric strength measurements are not reported, and it is stated that the values of this property appear to depend more upon the conditions of test than on the nature of the compound.—*No. 560, Scientific Papers of the Bureau of Standards.*

Space Charge That Surrounds a Conductor in Corona.—JOSEPH S. CARROLL and JOSEPH T. LUISIGNAN.—A qualitative analysis of the nature of the space charge created about a conductor in corona, with particular reference to relative magnitudes and polarities rather than actual quantity measurements. In tests with an arrangement of a wire and a cylinder and a wire and a plane a decided rectifying effect was discernible in the space about the conductor in corona, and in that region a unidirectional potential above ground was built up, the magnitude and polarity being dependent upon the voltage applied. This net rectification was apparently caused by some differential action entering into the ionization process and was of a positive character at the start of the corona but changed to a negative one as the voltage was raised. In a corona-loss curve taken upon two cable conductors it was found that at the same voltage at which the sign of the rectified space charge had reversed there was a break in the curve. This corresponded to the point above which Peek's quadratic law of corona holds and below which the entrance of a probability relation has been suggested.—*Report to American Institute of Electrical Engineers,* September, 1927.

Motors and Control

Heating of Windings Determined from Tests of Short Duration.—JOHN BASTA and FRANK FABINGER.—A mathematical discussion of the hot spot temperature rise in an electric machine from data obtained by a test load of short duration. The chief difference between this method and those previously used is that a simple exponential curve for the temperature rise has been assumed, while the present method endeavors to follow more closely the actual conditions. The formula, when derived, is applied to a specific problem and the results verified by actual tests.—*Journal of the American Institute of Electrical Engineers,* December, 1927.

Choice of Voltage for A.C. Motors.—AUBREY V. CLAYTON.—The factors influencing the decision to utilize high-voltage or low-voltage alternating-current motors for use in industrial installations have been reviewed. It is stated that the general items to be taken into consideration are reliability of service, economy of operation, capital cost or first cost, and space occupied. The question of reliability of service is rated as being most important, although it is stated that there is little or no difference between the high tension motor and the unit composed of transformer and low tension motors, provided the device using the higher potential is properly designed and manufactured. The author has considered the various factors of design and construction that enter into the development of rotating machines and concludes, as a result of this investigation, that the equipment operating at the higher voltages has, in general, definitely desirable characteristics.—*Electrical Review* (*England*), Dec. 2, 1927.

Heat Applications and Material Handling

Electric Heating Possibilities.—H. AMBROSE CARNEY.—A consideration of the objections and advantages involved in the use of electrically generated heat for domestic and industrial purposes is offered by the author. A low temperature system is advocated in preference to the use of high temperature elements. The disadvantages of instantaneous water heaters, the application of heat storage to cooking operations, and the requirements of a minimum rate are all considered in relation to the general problem. The author concludes that electric heating offers the greatest possibility for supply extension at the present time, and states that, because it can usually be fitted into existing load curves, its development should have an important effect in reducing the price of current for other purposes.—*The Electrician (England),* Dec. 2, 1927.

Electrifying the Hardening Room.—As the result of a conference held at Yale University, certain operating and cost data have been revealed. The practices in the shops of several machine tool and specialized metal manufacturing companies are reported. Among the features involved are statements regarding experience with electrically heated lead pots, production costs as reduced by electricity, analysis of the factors involved in the cost of electric furnace heat, the labor saving developed through the use of continuous furnaces and an analysis of the practices in the several plants.—*Iron Age,* Dec. 8, 1927.

Illumination

Color-Temperature Classification of Natural and Artificial Illuminants.—NORMAN MACBETH.—The recognition of the necessity for a quality rating of artificial light sources on the basis of color-temperature led to the development of an instrument for such determinations. The color-temperature of a source is defined as the temperature of a black body which has the same spectral distribution of radiation through the visible spectrum as the source in question. Comparative ratings for natural daylight and artificial light as well as for full sunlight and artificial light upon the basis of this color temperature scale are given. The colorimetric photometer developed for the purpose, and the analysis of illumination according to the results obtainable with this instrument are described by the author. The intimate relationship with industrial, commercial, residential and research applications is indicated with particular reference to the so-called daylight lighting.—*Transactions of the Illuminating Society,* 1927.

Radio-Frequency Equipment Used for Remote Control.—A plan for the control of street lighting circuits fed from distribution feeders at points remote from substations. The substation operator is enabled, by this plan, to control the turning on and off of street lights at remote points. The means of accomplishing this result, and a technical description of the transmitting and receiving equipment, as well as of the method of operation, is included in this article. The advantages claimed for this carrier current control include: the use of existing circuits for transmission of controlled energy; the normal distribution of current remains unaffected; interference with telephone circuits and radio is avoided; control is applicable to either grounded or ungrounded distribution systems; operation cannot be caused by lightning or stray currents; the on-and-off operations are so distinctive that no question of confusion is involved; and temporary interruption of power does not affect the condition of the control circuits.—*Electrical West,* Dec. 1, 1927.

The Present Status of Aeronautical Lighting in the United States.—PRESTON R. BASSETT, R. W. COST, E. A. LEINROTH and H. C. RITCHIE.—The general subject of the illumination of aeronautical fields, buildings and equipment is discussed. The type of fixture, the lighting intensity and the various special factors involved all receive attention. The illumination of indicating markers for route designations and the lighting of the planes to facilitate landings through the use of equipment installed upon the machine itself and the type of projector best adapted to the service are developed. The diversified conditions of local terrain, size and use of airports has led to the gradual development of new devices and improvement of old ones. Standardization has been delayed by high costs.—*Transactions of the Illuminating Engineering Society,* November, 1927.

Miscellaneous

Conservation of Wooden Poles.—F. DROUIN.—The portion of a wooden pole which is most subject to decay is the underground section. The author describes fifteen methods of providing a metallic or cement base for a wooden pole. A raw, unimpregnated pole, placed directly in the ground, is assumed by the author to have a probable life of five years. A well-impregnated pole may be anticipated to last fifteen years in service, but at least thirty years is given as a reasonable life if it is attached to any one of the described artificial bases.—*Revue Générale de l'Electricité,* Oct. 1, 1927.

News of the Industry

Governors of Upper Basin Adopt Resolution

Colorado, Wyoming, Utah and New Mexico Cling to the Original River Pact and Hope for Its Eventual Adoption by Seven States

REPRESENTATIVES of the four upper Colorado Basin states—Colorado, Wyoming, Utah and New Mexico—met in the office of Governor Adams at Denver on Dec. 19 and came to a unanimous agreement expressed in a resolution signed by Governor Adams of Colorado, Governor Dern of Utah, Governor Emerson of Wyoming, Delph Carpenter, Colorado water commissioner; Francis Wilson, New Mexico water commissioner; L. Ward Bannister, counsel for the city of Denver, and M. W. Mechem, former Governor of New Mexico. Governor Dillon of New Mexico is understood also to be in harmony with the resolution. It reads:

Whereas it is the conviction of the Governors and interstate water commissioners and other representatives of the States of Colorado, New Mexico, Utah and Wyoming, the four states of the upper basin of the Colorado River, that the interstate agreement embodied in form by the Colorado River compact as negotiated at Santa Fe, N. M., in November, 1922, should be completed and placed in full force and effect through approval and acceptance by the seven Colorado River states, in order that the way may be properly cleared for the orderly development of the Colorado River; and

Whereas substantial progress has been made during the past few months toward the completion of the said compact and negotiations are now being carried on in competent manner looking to completion,

Therefore, be it resolved that it is the firm belief of the representatives of the four upper basin states, as assembled at Denver this nineteenth day of December, 1927, that no legislation proposing the construction of any project on the Colorado River should be enacted by Congress, or otherwise authorized by any federal agency, before negotiations now in progress have been completed and every reasonable effort exhausted to reach such agreement between the seven states.

The Denver conferees are said to have expressed hope verging on confidence that the three lower basin states—Arizona, California and Nevada—would come to an agreement among themselves which would lead them all, including Arizona, to ratify the 1922 treaty.

No Agreement on Price of Colorado River Power

Conferences that were held daily in San Francisco starting Nov. 21 between members of the Colorado River commissions of Arizona, Nevada and California, their state engineers, consulting electrical engineers and other advisers, in an effort to determine what price Arizona and Nevada should receive from California for hydro-electric power to be generated if and when Boulder Dam is built, were terminated Dec. 17. At the close of the conference it was stated that while California had offered to pay a higher amount than its previous offer of four-tenths of a mill a kilowatt-hour, made at the last Denver conference, the figure had proved unacceptable to Arizona and Nevada. The price named by California was not made public. At the Denver conference one mill a kilowatt-hour had been asked by the other two states. One of the main difficulties that confronted the engineers at the San Francisco meeting was the determination of the probable cost of power at the time Boulder Dam is completed, which generally is set at ten years from the time the bill is passed.

George Malone, State Engineer of Nevada, who acted as chairman, said: "The next action will be taken when the Colorado commissions of the three states go to Washington early next year to talk with the congressional committee having the Boulder Dam bill in hand. Each commission will urge that certain provisions be incorporated in the bill. No commission will oppose the bill unless it finds that its state is being put at a decided disadvantage. Final decision will rest with the congressional committee."

Three Principles Adopted for Muscle Shoals Action

The House committee on military affairs has adopted three principles under which it will consider disposition of the Muscle Shoals project. They are as follows:

1. That property shall at all times be subject to the absolute right and control of the government for nitrates or other components of munitions of war, and that Nitrate Plant No. 2 (or its equivalent, or such other nitrogen fixation plant or plants adjacent or near thereto as may be constructed) must be kept available therefor by the purchasers, lessees or users of the property.
2. That the purchasers, lessees or users of the property shall be obligated in the strictest terms to the manufacture and sale to the public of fertilizers in time of peace.
3. That any proposal for the purchase, lease or use of the Muscle Shoals property of the United States government must be for the entire property.

These principles will, according to Chairman Morin, permit consideration of the plan proposed by Secretary Jardine and favored by the President.

Boulder Dam Hearings in January

Committees in Both Houses Will Take Up Colorado River Problem —Arizona Sending a Strong Contingent to Oppose Swing-Johnson Bill—The Phipps Measure

WASHINGTON reports are that the Senate committee on irrigation and reclamation will resume its Boulder Dam hearings on Jan. 17, an announcement to this effect having been made by Senator Phipps of Colorado, chairman of the committee. On this date an Arizona delegation headed by the Governor is scheduled to appear. It is believed that the delegates' purpose is to oppose the recent Boulder Dam bill introduced by Senator Johnson of California. This Arizona contingent will consist of eight men besides the Governor of the State, four appointed by him and four selected by the Legislature. Senator Phipps, who has himself introduced a Colorado River bill, has publicly expressed his desire to grant every side of the case a hearing. It is known, however, that he does not believe in putting the government in the power business. It is true that his Boulder Dam bill, submitted on Dec. 6, mentions power development as a by-product, but he expressly states in his measure that the use of water for power shall be subservient to the matters of flood control and irrigation.

Senator Phipps' bill calls for an appropriation of $90,000,000, whereas the Johnson measure would provide $250,000,000. The Johnson bill seeks to authorize the erection at Boulder Canyon of a dam capable of creating a storage reservoir of not less than 20,000,000 acre-feet. The Johnson bill further calls for the construction of a canal connecting the Laguna Dam with the Imperial Valley and stresses the development of electrical energy to the fullest possible extent.

Representative Addison T. Smith of Idaho, chairman of the House irrigation committee, has announced that Boulder Dam hearings will be started before that committee on Jan. 6. He states that on this date it is expected that the Governors of Utah and Wyoming will be present. These Governors are understood to be desirous to incorporate in the Boulder Dam legislation provisions of some type or another for protecting the water rights of the various states.

Mr. Smith's attitude on the question is clearly indicated by an open letter to him from Governor Dern of Utah which was printed in a California paper. In this letter Mr. Smith was charged with ignoring the interests of the entire West by his support of the Swing-Johnson bill, which measure, in the opinion of the letter, favored only California.

A Mississippi State Board Has Muscle Shoals Plan

A resolution on the Muscle Shoals problem has been adopted by the Mississippi State Board of Development, a state-wide organization maintained to promote the agricultural and industrial development of the State of Mississippi.

This resolution indorses the plan favored by Secretary of Agriculture Jardine and Senator Sackett of Kentucky. As briefly stated by the Mississippi board, it is a proposal "(1) to authorize distribution of surplus power to the public in such manner as to secure the best return, and (2) to apply the funds so derived to the construction and operation of nitrate plants at Muscle Shoals and in other fertilizer-using areas, using modern economical processes which require but little power, and, through agencies of the federal and state agricultural departments, to conduct experiments in the practical use of high-grade concentrated fertilizers on farms in the various states and thus create sufficient market demand that private industry will engage in its production."

President Coolidge's reference to Muscle Shoals in his recent message indicated approval of measures along such lines.

Southern Sierras' New Imperial Valley Line Finished

The Southern Sierras Power Company has completed an 88,000-volt transmission line between San Bernardino and the Imperial Valley, a distance of 67 miles. This provides the company with two main transmission lines into the Imperial Valley. The line is of wooden-pole, steel-wishbone type, poles running from 50 ft. to 75 ft. in height, with suspended insulators and heavy copper wire. The cost of the line has been set at about $4,200 a mile and with switching and terminal facilities will total close to $350,000. With this second line into the valley it is expected that interruptions will be materially shortened in duration. Heretofore when the transmission line between San Bernardino and the valley went out for any reason a connecting line with the San Diego Consolidated Gas & Electric Company, coming across the San Diego Mountains, was called into use, but it required some time to develop steam power sufficient in the San Diego plant to pick up the load.

The Southern Sierras Company, according to A. B. West, president, has invested $2,500,000 in the past four years for improvements of the Imperial Valley service.

B. C. Edgar Dies

Vice-President and General Manager of Tennessee Electric Power Company Succumbs After Illness—Had Been Head of Southeastern N.E.L.A.

B. C. Edgar, vice-president and general manager of the Tennessee Electric Power Company, who had been ill for some time, died on Dec. 26 at his home on Lookout Mountain, Chattanooga. Mr. Edgar was also president of the Nashville Railway & Light Company and had long occupied prominent posts in the electric light and power and electric railway fields.

Mr. Edgar was born in Rahway, N. J., in 1878 and in his early boyhood became interested in the rapidly developing science of electricity. He was graduated in electrical engineering from Rutgers College, New Brunswick, N. J., in 1900. He was first employed by the Manhattan Railway, New York City,

B. C. EDGAR

in changing steam-driven trains to electrical operation. Later he was identified with the electrification of the tubes under the Hudson River.

From 1909 to 1912 he was in San Francisco and in Portland, Ore., with the Southern Pacific System. Among his tasks was one connected with the electrifying of suburban railway lines from Oakland to Berkeley, Cal. From 1912 to June, 1914, Mr. Edgar was assistant general superintendent of the Columbus (Ohio) Railway, Power & Light Company. He was made general superintendent of the Nashville company in the latter year, and in February, 1919, he was elected to the vice-presidency of the Chattanooga Railway & Light Company, the Nashville Railway & Light Company and the Tennessee Power Company. In February, 1923, when the Chattanooga Railway & Light and the Tennessee Power were merged with the Chattanooga & Tennessee River Power Company into the Tennessee Electric Power Company, Mr. Edgar was continued as vice-president and general manager of the merged company. In December, 1925, he became president of the Nashville company. Under his administration the Tennessee companies have grown greatly.

In May of last year Mr. Edgar was elected president of the Southeastern Division of the National Electric Light Association, and he presided over the annual convention held at Memphis last spring.

Radio Short-Wave Hearings to Be Held on Jan. 17

Wide interest has been aroused in public hearings on the radio short-wave situation announced by the Federal Radio Commission to be held at Washington, beginning at 10 a.m., Jan. 17. Many different groups have requested opportunity to present their claims to channels in this part of the radio spectrum. Among those applying to be heard are numerous electric power transmission systems.

In view of the impossibility of assigning a channel to every applicant, representatives of each class of service applied for will be particularly invited to discuss (1) the dependence of such service upon short-wave radio rather than wire or other means, (2) the humane, social and economic importance of their proposals, (3) the number and position of channels believed available for such service, (4) power required and interference likely to be caused to other services and other countries, and (5) the probable total number of applications which will be made for such service within the next five years by all applicants in their class.

Airway Lighting for Pacific Coast Service

In its program of lighting important air-mail and commercial airways the Bureau of Aëronautics, Department of Commerce, has under way installation of an extensive system of beacon lights and lighting of emergency landing fields on the Pacific Coast. Contracts recently have been let for lighting 390 miles of airway between San Francisco and Los Angeles, and surveys have been completed for extending the lighting to Redding, Calif.

The government's program calls for completion of airway lighting between Los Angeles and Seattle, Los Angeles and Salt Lake City and San Francisco and Salt Lake City within the next year, a total distance of approximately 2,500 miles. Revolving beacon lights are to be placed every 15 miles and illuminated emergency landing fields every 30 miles. Central-station service will be utilized where available, otherwise a 2-kw. gas engine set will be installed for beacon lights and a 4-kw. set for emergency landing fields. Keeping pace with this lighting program, several of the larger cities on the Pacific Coast recently have installed illuminated municipal airports. The connected load of these airports runs as high as 400 kw. and central stations have found it desirable.

P. G. & E. Is Finishing Many 1927-1928 Jobs

Rebuilding of East Bay Station Nearly Completed—Start Is Made on Big 84,000-Hp. Project on Mokelumne River

THE East Bay steam-electric generating station of the Pacific Gas & Electric Company—Station C in Oakland—is almost ready for the installation of a 50,000-hp. turbine. The old turbine, which it is to replace, has been taken out, the salt-water intake is finished, and the work of putting in the new turbine, boilers and other equipment will soon begin. Altogether the job will cost $2,640,000, and the reinforced standby station will be running at its new and greater capacity before summer comes.

Other work now in progress and which will be finished next year includes the erection of substation N in the Sunset district, San Francisco; the Clear Lake substation, which will furnish power for the Sulphur Bank mine; the Agnew substation in Santa Clara County, installation of a new condenser and an additional bank of transformers at the Salinas substation, the construction of 5½ miles of steel-tower line to replace the old pole line between San Mateo and San Bruno, and the installation of a new salt-water pumping system at the steam-electric generating station in the Potrero district of San Francisco.

The largest construction job under way is, however, the Mokelumne River development, which will take several years to complete, as it involves the building of a rock-filled dam 1,300 ft. long and 300 ft. high across the Mokelumne, 50 miles above Jackson; a conduit, part tunnel, part open, more than 20 miles long; a 12,000-hp. generating plant at Salt Springs and a great power plant of 72,000 hp. capacity on Tiger Creek. Preliminary work on the project began last June. Now the construction road from Martell to the site of the dam is finished, electric shovels, locomotives and dump cars have been moved in, and the long job of placing rock in the great dam wall is under way.

Americans Will Build Power Plant at Estevan, Sask.

Exchange of ideas concerning electrical power and construction took place recently at Bismarck, N. D., when a group of prominent citizens and power experts from Saskatchewan, Canada, were guests of E. A. Hughes, president of the Hughes Electric properties. The Canadians were welcomed by Governor A. G. Sorlie and after a banquet made an inspection tour of the Hughes Electric properties in North Dakota with special reference to the adaptation of the lignite deposits of their province to the production of electric power. E. H. Morris, chief engineer of the North Dakota Railroad Commission, told about the growth of high-tension lines in that state, asserting that at the present time there are more than 2,000 miles of line in the state, and including the information that there are only two municipal public utilities of any size in the whole commonwealth.

Coincident with the entertainment of the delegation from Saskatchewan, Mr. Hughes announced that the Northern Light & Power Company, a Canadian corporation recently organized by a group of business men of the United States, contemplates a five-million-dollar power project which will embrace approximately 10,000 square miles in the southeastern section of Saskatchewan. Power plants have already been acquired at Indian Head, Wolseley, Moosomin and Grenfell, Saskatchewan, and a movement is on foot to acquire other private and municipally owned plants in neighboring cities and towns. Plans call for the establishment of the basic generating plant at the lignite fields in the vicinity of Estevan.

River Shannon Project Is Making Progress

Development of the River Shannon hydro-electric power project, which will eventually serve a large percentage of Ireland, was started early last year, and the first units are expected to be ready in 1928. The headrace will be 7½ miles long, and a fall of 100 ft. will be obtained. The generating station is being erected about two miles from Limerick.

The project is to be developed in three stages. The initial development will consist of three turbo-generator sets rated at 30,000 hp. each. The second installation calls for the addition of 180,000 hp. of generating capacity. The third stage plans call for the installation of additional generating capacity together with increased water storage. Ultimate cost will be $25,000,000.

Irish Free State officials have estimated that the demand for power will be about 51,900 kw. at the completion of the first stage of the development. Power will be sent over 110-kv. lines to the larger cities.

New Plans Proposed for Power Quiz

Federal Trade Commission or Financial Experts May Be Asked to Carry Out Investigation on Lines of Senator Walsh's Resolution

By Paul Wooton
Washington Correspondent of the Electrical World

IT IS recognized in Washington that the failure of the interstate commerce committee of the Senate to report out the Walsh resolution in some form or other would have the effect of creating a political issue of the utilities situation just as surely as it would be created were an investigation undertaken by a special committee of the Senate. The indications all are that the electrical industry itself has no desire to see the resolution die in a committee pigonhole. Since grave charges have been made, it is believed that an opportunity should be afforded to prove that they are incorrect or, at least, do not apply in more than isolated instances. The only desire is to remove such an inquiry as far as possible from the field of partisan politics.

The more general feeling seems to be that the committee should amend the Walsh resolution so as to empower the Federal Trade Commission to carry forward the investigation along the lines he proposes. Some are of the impression, however, that the Federal Trade Commission is not equipped to conduct an investigation of this type. In that connection it has been suggested that the investigation be conducted by an independent commission which would be set up for the purpose, to be composed of outstanding authorities on corporate financing. President Hadley of Yale, Professor Ripley of Harvard and men of financial and banking experience are suggested as those who should make up the investigating commission.

A bill putting into legislative form the administration's plan for the disposal of Muscle Shoals is understood to have been prepared. It is expected that the bill will be introduced shortly after the reconvening of Congress. It is said to follow the plan outlined in the President's message to Congress.

Arc Welding Allows Bridge to Be Used as It Is Rebuilt

A novel engineering operation is to be performed on a steel bridge owned by the Public Service Railways Company near Bound Brook, N. J. By means of the arc-welding process a new structure is to be built inside of the present one and the old members then burned away and removed. This will be done without closing the bridge to electric railway and vehicular traffic.

"The reconstruction of the Public Service Company's Bound Brook bridge, while not important from a dollars and cents standpoint, is extremely interesting to engineers," said Gilbert D. Fish, consulting structural engineer of the Westinghouse Electric & Manufacturing Company, who is in charge of the work. "This bridge has to be made to withstand the weight of the heaviest of interurban electric cars. To do this by means of any of the usual methods would require the construction of an entirely new bridge, but by employing arc welding about half of the existing structure can be retained, the new members can

be welded in place, and the old members can then be removed, without having to resort to shoring or falsework or stopping traffic over the bridge. The cost of the work will be a small fraction of that for any other known method and the time required will be comparatively short."

Keeping Up with Texas

Notes on Construction Finished or Under Way by Seven Companies Serving Among Them Many Large Sections of the Lone Star State

NO STATE in the Union outdoes Texas in ceaseless electrical activity, due in large part to the ever-growing opportunity to serve oil fields in drilling and pumping. Recent items of construction news in the Lone Star State reported by ELECTRICAL WORLD correspondents are as follows:

An expenditure of approximately $1,203,000 for enlargements and improvements to its holdings in the Beaumont district will be made by the Gulf States Utilities Company during 1928, according to J. G. Holtzclaw, vice-president and general manager of the company. The largest single item of expense, $353,000, will go to provide facilities for additional customers in Beaumont, Port Arthur, Orange, Jasper, Silsbee and Hull. Of this amount, Mr. Holtzclaw said, $335,000 will be divided between Beaumont, Port Arthur and Orange. The next largest item, $250,000, is for the construction of a new substation to replace the present one. The new substation will distribute power from the Neches plant. The company has built an addition to the Neches station, which will give the plant a capacity of about 25,000 kw. in 1928, an increase of about 25 per cent. Next in order come expenditures of $250,000 for a third high-tension line between Beaumont and Port Arthur and of $100,000 for the installation of voltage regulators and other improvements. In Port Arthur $35,000 has been provided for the complete rehabilitation of the city's street-lighting system, and at Orange $40,000 will be spent for improvement of the Orange power station's boiler equipment.

E. B. Neiswanger, vice-president of the Central Power & Light Company, says that it must not only rush construction work on its hydro-electric plant on the Devil's River, 20 miles from Del Rio, Tex., but must also rush 154 miles of transmission line to completion and make immediate steps for increasing its power supply at Del Rio and Uvalde. This is necessary to fill a contract for power to operate oil-pumping plants. "The new wires," Mr. Neiswanger says, "will be stretched from the Val Verde-Crockett County lines through Del Rio to Uvalde, and our sister company, the West Texas Utilities, is building approximately 70 miles for a connection with our lines."

Construction by the Texas-Gulf Power Company of a power plant at Texas City, Tex., to cost $300,000, is about to start. Since the company took over the local plant it has linked it up with Dickinson, League City and Friendswood, and it will soon construct another line up the bay shore to Clifton-by-the-Sea, via San Leon. The company's extensions are making electric power available for thickly populated rural communities.

The Texas-Louisiana Power Company will, it is understood, soon spend $375,000 in the construction of a new power plant at Pecos. The company's transmission line to the Barstow irrigated district has been reinsulated and otherwise improved. An extension of the high-tension system of the company to other towns and to the oil fields of Pecos and Winkler Counties is planned. The lines will be of wooden-pole construction.

The new power plant of this company, at Silver City, N. M., which will cost $300,000, will be completed and placed in operation some time in January. Twenty miles of transmission lines have been built to supply Fort Bayard, Central, Fierro, Hanover, Boston Hill and a number of farms and ranches. When the company purchased the plant in 1925 it had a generating capacity of 300 kw. By December, 1928, this will be increased ten times. Diesel-type oil-burning engines are used.

An expenditure of $4,000,000 was made during 1927 by the Texas Electric Service Company in constructing power lines and making electric installations in the oil fields of west Texas, according to M. J. McCall, division engineer. This sum is in addition to the $2,000,000 which was spent at Odessa in the construction of a power plant designed for 3,750 kw. capacity, of which six Diesel engines now furnish 2,250 kw.

Citizens of Colorado, Tex., are to vote on a proposal to issue bonds for the construction of a municipal electric plant. At present the town is served by the Texas Electric Service Company.

Construction has been started by the Houston Lighting & Power Company of a new substation which will serve the North Side from Houston Heights east to the Turning Basin. The substation will cost $250,000 and will be completed early in February.

The Lufkin and Nacogdoches light and power plants have been connected with the Texas Power & Light Company lignite-burning plant at Trinidad. Work on the 60,000-volt line was started in July, its length being 100 miles, nearly all of which was through timbered territory, a right-of-way 100 ft. wide having to be cut and the timber burned.

Purchases and Mergers

Two Large Iowa Utility Companies Are to Form Part of the Utilities Power & Light of Chicago—P. G. & E. Buys Another Plant.

ACQUISITION by the Utilities Power & Light Company of Chicago of the Central States Power & Light Corporation of Davenport, Iowa, operating in 187 towns and communities in Iowa, Missouri, North Dakota, Oklahoma and Arkansas, at a cost of $9,000,000, and completion of preliminaries to the purchase of the Federal Public Utilities Company of Dubuque, Iowa, a fifteen-million-dollar corporation with properties in Iowa, North Dakota, Missouri, Arkansas, Oklahoma, Louisiana, Alabama, Michigan, Minnesota and Canada, has been made public. The Davenport company, owned by Priester, Cundy & Quail, a Davenport investment concern, was sold to the Central State Utilities Company, a subsidiary of the Utilities Power & Light, and will be merged with other utilities in the district served. H. C. Orton, vice-president and general manager of the Interstate Power Company, Dubuque, also a subsidiary of the Utilities Power & Light, announcing the negotiations, said that properties of the Interstate Power will not be merged immediately with those newly acquired, but for a time will be conducted as a separate unit under his management. The Northeastern Iowa Power Company, owned by Davenport interests, is a part of the Federal Public Utilities.

Holdings of the Arkansas Public Service Company at Ola, Danville, Berryville and other towns in northern and western Arkansas were affected by the transfer of the Central States Power & Light Corporation. Plants of the Southern Edison Company, which is included in the transaction, are operated at Leslie, Pangburn, Des Arc, Stamps and other Arkansas towns.

The Tuolumme County Electric Power & Light Company has been bought by the Pacific Gas & Electric Company for $160,500, subject to the approval of the California Railroad Commission.

An order issued by the Missouri Public Service Commission gives the Missouri Edison Company of Louisiana, Pike County, authority to buy the electrical properties owned and operated by A. H. Latimer and James W. Peterson at Elsberry, Silex, Curryville, Annada, Cameron, Whiteside, Paynesville and Turpin, in Pike and Lincoln Counties. The price to be paid for the properties is $265,135.

The Oklahoma Gas & Electric Company has offered $40,000 for the electric distribution system of the City of Tecumseh, in that state.

Opposition has manifested itself before the New York Public Service Commission to the petition of the New York State Gas & Electric Corporation for authority to acquire the outstanding stocks of the Plattsburgh Gas & Electric Company and the Harlem Valley Electric Corporation, and to the petition of the Harlem Valley Electric Corporation to acquire the stock of the Wynantskill Hydro-Electric Com-

pany. The petitions of the two companies also asked for approval of mergers.

Final argument in the suit to restrain the Public Service Electric & Gas Company of New Jersey from absorbing five leased companies (see ELECTRICAL WORLD for July 2, page 34) is set for April 12. Stockholders of the companies involved have voted for the amalgamation.

The Illinois Power & Light Corporation has been authorized by the Illinois Commerce Commission to purchase the Carlock (Ill.) Power & Light Company for $35,867.

Sale of the municipal plant of Bagley, Iowa, to the Iowa Railway & Light Corporation will be voted on at a special election Jan. 25.

Milton, Fla., is reported to be considering the bid of the Gulf Power Company of Pensacola for its municipal light and power plant.

By a vote of 210 to 79 the citizens of Truckee, Calif., have decided to place that municipality in the light and power business. The town has the choice of buying out the Truckee Electric Light & Power Company, the local utility, or of building a new distribution system and obtaining power from the Truckee River Power Company of Reno, Nev. According to present plans, the latter action probably will be taken.

Status of Southern California Edison-Los Angeles Suits

By an action in the Superior Court of Los Angeles County the Southern California Edison Company, as previously recorded, is attempting to have a court order issued which will permanently restrain the city of Los Angeles from constructing a steam plant at Los Angeles Harbor. In these proceedings the Edison company is acting as a taxpayer and contends that the city has no valid budget appropriation to use for this purpose.

It is further contended that an illegal transfer of funds from one appropriation to another is threatened. The Bureau of Power and Light is desirous of constructing a standby steam plant on the tidelands at the harbor. These tidelands were given to the city by the federal government in trust for the purposes of furthering commerce, navigation and fisheries. It is the contention of the Edison company that the attempt to construct a steam plant on these lands is in direct opposition to the purposes for which they were granted.

Another suit is under appeal at the present time. In this second suit the Edison company is attempting to prevent the city from action which the company holds would break the contract made with the company at the time the Edison company sold out its Los Angeles distribution system to the municipality. At that time—1922—a contract was entered into whereby, the company contends, the city agreed to purchase all power which it needed in excess of its hydro-electric capacity from the Edison company until 1932 and further agreed that until that date it would not build any steam plants. In the hearing of this case the city filed a demurrer, which was sustained by the court, and from this decision the Edison company has appealed.

Briefer News

MADISON (WIS.) COMPANY TO HAVE TEN-STORY OFFICE BUILDING.—Property has been purchased by the Wisconsin Power & Light Company in the heart of the downtown business district of Madison, Wis., upon which an office building and bus terminal will be erected, according to an announcement by G. C. Neff, vice-president. The tentative plans call for a ten-story office building. Construction work will be started early next year.

BUFFALO GENERAL ELECTRIC ILLUMINATES ITS OFFICE BUILDING.—The many light and power companies that own ornamental office buildings often resort, especially at this time of the year, to floodlighting and special schemes of illumination to enhance the beauty of

the structures. The upper three sections of the tower of the Buffalo General Electric Company's building are this year lighted up in three separate colors —white, green and purple respectively.

SEVEN GREAT TRANSFORMERS FOR CONOWINGO.—Capable of furnishing sufficient electrical power to light, heat and transport a city of possibly half a million people, the seven transformers which will serve the Conowingo hydro plant of the Philadelphia Electric Company have just been completed at the Sharon works of the Westinghouse Electric & Manufacturing Company. Each of the transformers stands over 31 ft. in height, weighs over 200 tons and has a voltage of 220,000. Several cars will be required to ship each transformer, and to carry the heaviest part it has been found necessary to build a special flat car having twelve wheels and a carrying capacity of 220,000 lb.

CONSTRUCTION OF GORGAS NO. 2 GENERATING STATION BEGUN BY ALABAMA POWER COMPANY.—Further details of the plans for Gorgas steam plant No. 2, which was announced recently by the Alabama Power Company (ELECTRICAL WORLD for Nov. 26, page 1107), stress the fact that the 60,000-kw. single-shaft turbo-generator will be the largest of its type in the South. This General Electric unit will generate 13,800 volts, the energy being stepped up to 40,000 and 110,000 volts. The new Gorgas plant will eventually involve an expenditure of approximately $24,000,000, according to statements made by officials of the Alabama Power Company, and its ultimate capacity will be 240,000 kw. Work has already started. Fifty houses, which are to constitute the permanent camp, are being constructed, together with such temporary buildings as are necessary. A complete fuel pulverizing and burning system, with furnace water walls and air preheaters, has been purchased from the Combustion Engineering Corporation. The engineering department also announces the purchase of a 70,000-sq.ft. Worthington condenser and two Babcock & Wilcox boilers, each with 30,000 sq.ft. of heating surface.

BUFFALO, NIAGARA & EASTERN SYSTEM RENAMES ITS STATIONS.—When the name of the River Road steam station of the Buffalo and Niagara system was changed to the Charles R. Huntley station last year an idea was initiated that has led to the original names of other stations being dropped and replaced by those of individuals. The main Niagara hydro plant is now known as the Schoellkopf station in honor of Jacob Schoellkopf, Niagara No. 1 and Niagara No. 2 are known as the Edward Dean Adams plants, the Canadian plant at Victoria Park, across the river, is called the William B. Rankine station, the big switching station at Niagara Falls is now the John L. Harper plant, while a new distributing station on the Lockport Road is the Norman R. Gibson station, in honor of the late Mr. Harper's successor as chief engineer.

MONTANA'S NEED FOR MORE POWER.—A need for two million more electrical horsepower in Montana is declared to exist by Dan Kelly of Butte, attorney for the Rocky Mountain Power Company, which is seeking a preliminary survey of the power possibilities of the Flathead basin. Mr. Kelly, testifying before Major J. F. Butler, representing the Federal Power Commission, cited the Anaconda zinc plant and the proposed

aluminum plant of the Anaconda Copper Mining Company as instances of the need for additional power and declared that, while the Flathead site was considered best, the power will be developed at some point within the state. H. H. Cochrane, chief engineer of the Montana Power Company, explained that it is the purpose of the company to build a dam 4 miles below the outlet of Flathead Lake with spillways to control flood conditions. Objections to raising the level of the lake were offered by farmers and others who proposed a commission of five to determine the amount of damages which would be suffered and demanded that any construction permit to be issued provide for the payment of damages.

MINNESOTA'S NEED FOR WATER-POWER LEGISLATION.—Action on the Minnesota Power & Light Company's application to the Federal Power Commission for a license for water-power development in and near the Superior National Forest has been deferred pending determination of its right to acquire title or use of state lands and determination of the state's authority. This announcement is made by the state authorities of Minnesota, whose protest against the state's not being consulted in the issuance of federal licenses was recorded in the ELECTRICAL WORLD for Dec. 24 (page 1319). Since the federal water-power act is drawn on the assumption of combined state and federal control, members of the Federal Power Commission are said to consider that this case is an excellent example of the need for definite water-power legislation in Minnesota.

DINNER TO W. W. FREEMAN.—In connection with the presentation of the James H. McGraw award for co-operation to W. Winans Freeman, the directors of the Society for Electrical Development have issued invitations for a testimonial dinner to be held on Tuesday evening, Jan. 10, at 7 o'clock, at the Hotel Roosevelt, New York. Mr. Freeman, chairman of the board of the Union Gas & Electric Company, Cincinnati, and vice-president of the Columbia Gas & Electric Corporation, New York, is also president of the Society for Electrical Development. The medal is to be presented in recognition of the contribution he has made to the progress of co-operation among electrical men through the reorganization of the directorate of the Society for Electrical Development, in which the chief executives of the four national associations and the League Council now sit as an informal council of the industry.

PUGET SOUND POWER & LIGHT GETS FRANCHISE COVERING A THOUSAND ROADS.—To the Puget Sound Power & Light Company has been granted a 50-year franchise covering the right to erect poles and power-transmission and telephone lines along approximately a thousand roads in Kings County, Wash. The Board of County Commissioners approved the franchise by a unanimous vote. Officials of the company say that the granting of the franchise does not forecast any special program involving rural expansion.

ARIZONA IRRIGATION AND POWER PLAN.—The Salt River Valley Water Users' Association of Arizona has been advised by E. W. Michael, president of the Verde Irrigation and Power District, that he has signed an agreement for the marketing of $23,000,000 worth of district securities at an average price of 91 per cent of face value. This is subject to approval by the association, which may take over administration of the district and install an irrigation system within its area, to the extent of 80,000 acres, lying north and northeast of Phoenix. The Verde project includes plans for generation of a large quantity of hydro-electric power along the Verde River following diversion of the flow of the stream at a dam about 50 miles northeast of Phoenix, the water to be conducted thence by a great canal that would end in a western extension of Paradise Valley. The Salt River Valley Water Users' Association has recently sent to the Commissioner of Irrigation a check for $708,951, which represents the 1927 payment on advances made by the government toward the construction of the Roosevelt Dam project. This provides the Arizona farmers within the district with their irrigation water and power.

PROGRESS OF COMMONWEALTH UTILITIES CORPORATION IN COLORADO.—The Commonwealth Utilities Corporation, which early this year purchased the electric plants in Akron, Genoa, Limon, Otis and Simla in eastern Colorado and which also controls the Eagle River Electric Company, serving Eagle, Gypsum and surrounding country in western Colorado, has completed a 44,000-volt transmission line connecting Akron and Otis and another line connecting Limon and Genoa. From Limon a line will connect Calhan, Matheson, Ramah and Simla. The company is making an investment of $1,500,000 in the territory named, to which must be added its new power plant at McGregor, Col., which is serving the coal country and various cities along the Denver & Salt Lake Railroad.

UPSTATE NEW YORK COMPANIES REPAIRING STORM DAMAGE.—Damage done by a severe storm on Dec. 16 will cost public service agencies of Syracuse, N. Y., close to a million dollars, according to recent estimates. The Syracuse Lighting Company has spent more than $100,000 and has two hundred extra men at work, who are likely to be kept busy for several weeks replacing broken poles and wires. At Fulton power was shut off from the street lamps for almost a week, and also in part from private service, hundreds of poles belonging to light and telephone companies having gone down. More than five hundred men are at work repairing the damage.

CAMBRIDGE COMPANY WANTS COMBINATION RATE.—In a supplementary petition to the Massachusetts Department of Public Utilities the Cambridge Electric Light Company asks the board to make provision in any order it may make in the pending rate case for an optional residence lighting rate which shall include a fixed charge based on the floor area of the customer's premises and that such fixed charge per month shall be 75 cents plus 4 cents per 100 sq.ft. The company declares that such a rate would be immediately beneficial to a great many customers. It is further requested that the commission make provision in the general lighting rate for a monthly fixed charge of 75 cents to each customer.

ELECTRICAL LEAGUE OF UTAH ELECTS OFFICERS. — Officers of the Electrical League of Utah for 1928 have been elected as follows: President, R. M. Bleak, Utah Power & Light Company; vice-president, J. M. Perlewitz, Graybar Electric Company; secretary-treasurer, G. W. Forsberg, Wasatch Electric

A New Year's Epitome of "Electrical World" History

The *Electrical World* (published under that name since 1883 and tracing its history back to 1874) is a consolidation of the *Electrical Engineer* (founded in 1882 as the *Electrician*) and the *American Electrician* (founded in 1896). Final consolidation under the title of *Electrical World* took effect on Jan. 1, 1906, the *Electrical World* and the *Electrical Engineer* having been acquired by the McGraw Publishing Company in 1899 and amalgamated as the *Electrical World and Engineer*, and the *American Electrician*, a McGraw monthly, having been absorbed seven years later.

The roster of past editors of the *Electrical World* includes Carl Hering, Louis Bell, W. D. Weaver, T. C. Martin and many other men prominent in the electrical industry—some, like those named, no longer living, and others, like C. O. Mailloux, A. S. McAllister, Frank F. Fowle, F. M. Feiker, D. H. Braymer and H. V. Bozell, still active in engineering and industrial service. William H. Onken, Jr., is now editor and L. W. W. Morrow managing editor. Other members of the present staff are: Earl Whitehorne, commercial editor; Allen M. Perry, associate editor; G. F. Wittig, statistical editor; H. M. Cameron, financial editor; F. C. Wells, news editor; Eustace C. Soares, manufacturing and markets editor; E. R. Searles and E. M. Glennon, assistant editors; F. R. Innes and T. P. Kindig, Western editors; H. S. Knowlton, New England editor; Walter C. Heston, Pacific Coast editor, and Paul Wooton, Washington correspondent.

Company. A course of free weekly lectures on subjects covering various phases of the electrical industry has been arranged by the league. These lectures, which have already begun, will be presented by local men chosen to present subjects associated with their particular branch of activities.

PROGRAM FOR AMERICAN ENGINEERING COUNCIL'S WASHINGTON MEETING.—To aid in solving the problem of flood control, the American Engineering Council will urge Congress to authorize an inventory of the water resources of the United States under the direction of the Geological Survey, it is announced by the President of the Council, Dean Dexter S. Kimball of Cornell University, who says that the question will be discussed at the annual meeting of the council to be held in Washington on Jan. 10 and 11. Reorganization of the Department of the Interior to accomplish centralization under engineering supervision of the public works functions of the government will also be discussed at the council's meeting, when a program of action for 1928 will be adopted. Sir Esme Howard, British Ambassador, will be the chief speaker at the annual dinner on the evening of Jan. 10.

THREE-STATE TIE-IN WILL HELP ARKANSAS INDUSTRIAL PLANT TO GET POWER.—A contract for 4,500 hp. of electrical energy between the American Portland Cement Company and the Southwestern Gas & Electric Company of Shreveport, La., for the former's concrete plant at Foreman, Ark., has been signed. It is estimated that 1,140,000 kw.-hr. will be consumed monthly. The power will be sent over the 66,000-volt line from Shreveport to Ashdown, Ark., whence a line of the same voltage is being extended into Foreman. Plants in Oklahoma will take over part of the load in case of an emergency.

SEATTLE'S CITY ENGINEER THINKS AMBURSEN DAM TOO COSTLY.—Plans which, it is expected, will force an early settlement of the Hanging Rock dam controversy in connection with the pending Skagit development program involving $8,650,000 have been announced by City Engineer Morse of Seattle. He plans to lay before the City Council a proposed contract with the Ambursen Dam Company, the stipulation having been made that the dam must be of the Ambursen type. Mr. Morse considers the price entirely too high and wants instructions.

RAPID CONSTRUCTION AT PAUGAN FALLS.—Construction work is progressing so rapidly on the hydro-electric development of the Gatineau Power Company at Paugan Falls, Quebec, that it is expected the first generator will be in operation and delivering energy by the early summer of 1928. The plant, which is on the Gatineau River, 33 miles north of Ottawa, is designed for 272,000 hp. in eight generators of 34,000 hp. each, of which six will be installed initially. The concrete dam across the river has been completed, the steel framework of the power house is up, and the penstocks are now being installed. The plant, as before explained, is one of the three which the Gatineau Power Company, a subsidiary of the International Paper Company, is constructing on the river, the other two, now in operation, being at Chelsea and Farmers Rapids, 7 miles north of Ottawa.

ELECTRICITY COMES HIGH IN TOMBSTONE.—Tombstone, Ariz., has completed a municipal electric light and power plant at a cost of $25,000. Rates run from 18 down to 10 cents per kilowatt-hour, according to the amount used.

NORTHERN OHIO POWER'S AKRON FRANCHISE RENEWED.—The City Council of Akron, Ohio, has renewed the franchise of the Northern Ohio Power & Light Company. The new franchise provides these rates, which differ only slightly from those formerly in force: 8 cents for the first 15 kw.-hr., 5 cents for the next 45 kw.-hr. and 3 cents for all over 60 kw.-hr. used. Advocacy of a "public utility expert" for Akron in place of the city safety director has attracted some attention in that city, the reason advanced being that "the city has no expert to defend its interests."

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see the ELECTRICAL WORLD for July 2, page 50.]

American Engineering Council—Washington, D. C., Jan. 9-11. L. W. Wallace, 26 Jackson Place, Washington.

Empire State Gas and Electric Association—Electric Section, Niagara Hotel, Niagara Falls, N. Y., Jan. 12 and 13. C. H. B. Chapin, Grand Central Terminal, New York.

Electrical League Conference — 30 North Dearborn Street, Chicago, Jan. 16 and 17. Society of Electrical Development, 420 Lexington Avenue, New York.

New England Electrical Credit Association—Boston, Jan. 17. C. A. Kane, 176 Federal St., Boston.

N.E.L.A. Commercial Section—Edgewater Beach Hotel, Chicago, Jan. 18-20. A. J. Marshall, 420 Lexington Avenue, New York.

National Electrical Manufacturers' Association — Supply Division, Hotel Commodore, New York, Jan. 23-27. S. N. Clarkson, 420 Lexington Ave., New York.

Artistic Lighting Equipment Association—Winton Hotel, Cleveland, Jan. 25-28. G. P. Rogers, 711 Graybar Bldg., New York.

Northwest Association of Electrical Inspectors—Olympic Hotel, Seattle, Jan. 26-28. F. D. Weber, 414 Lumbermen's Building, Portland, Ore.

American Institute of Electrical Engineers — Winter convention, New York, Feb. 13-16. F. L. Hutchinson, 33 West 39th St., New York.

Rocky Mountain Division, N.E.L.A.—Albuquerque, N. M., Feb. 14-16. O. A. Weller, 900 15th St., Denver.

Midwest Power Conference — Hotel Stevens, Chicago, Feb. 14-17. G. E. Pfisterer, 53 West Jackson Blvd., Chicago.

Northwest Electric Light and Power Association — Commercial Section, Portland, Ore., Feb. 20 and 21. J. C. Plankington, Northwestern Electric Company, Portland, Ore.

KANSAS CITY POWER & LIGHT COMPANY'S 1928 BUDGET TOTALS $8,000,000.—The Kansas City Power & Light Company, which spent $2,500,000 in extensions and improvements in 1927 exclusive of an equal amount paid for the street-railway power plant, has authorized for 1928 a budget reaching $8,000,000. For re-equipping the plant just referred to $2,800,000 is set aside, including $750,000 for new boilers. The sum of $800,000 for two new boilers at the Northeast plant is part of $1,850,000 to be expended there. At each plant a new high-pressure 10,000-kw. turbogenerator will be installed. The next largest classification, $2,880,000, is allotted for underground and overhead work, new substations and extensions through the developing suburban belt.

VIRGINIAN MUNICIPAL PLANT TO PAY SALESMAN.—A complete change in the policy which has governed the municipally owned power plant of Danville, Va., will be brought into play on Jan. 1. The city is to engage the services of a trained salesman, who will seek new business and try to increase the demand for city-generated power. Provision for his salary is being made in the budget. The plan is to operate the utilities as though privately owned, and the city will not be content to supply energy as the demand comes for it. Under the new plan suburbs will be able to get service, which will be offered them at a slightly higher rate than that paid by the citizens of Danville.

KENTUCKY & WEST VIRGINIA POWER COMPANY'S MINE SERVICE BENEFITS FROM INTERCONNECTION.—The Kentucky & West Virginia Power Company, with its main plant at Lothair, below Whitesburg, Ky., has spent $400,000 in improvements in 1927. Line extensions have been made into Virginia, West Virginia and Ohio, one line extending as far north as Zanesville, Ohio. The company serves 95 per cent of the coal-operating companies in the eastern Kentucky field. In the event of a suspension of service at Whitesburg they can now be supplied from numerous other sources.

ZONING SYSTEM PROPOSED FOR ONTARIO HYDRO.—It is reported that unless technical complications are encountered by officials of the Ontario Hydro-Electric Power Commission the provincial government will at the forthcoming session of the Legislature make changes in the act providing for rural transmission of power. The changes will provide, it is understood, for the establishment of zoning systems over which considerable areas will have a uniform rate. Zone units will probably be townships in the more thickly populated areas. Such an arrangement is known to be favored by Premier Ferguson.

Commission Rulings

THOSE INVOKING COMMISSION'S AID TO BETTER SERVICE CANNOT RETREAT FOR FEAR OF HIGHER RATES.—The Nebraska State Railway Commission has held that where the patrons of a public utility in a community challenge the character of the service furnished and invoke the state regulatory body's powers to compel the substitution of another system of service by asking it to cite the company to show cause why betterments should not be made, they cannot, after a hearing and out of a fear that the new schedule of rates will be higher than they wish to pay, end the inquiry. The commission says that, when its power has been invoked and the necessity of a more modern service demonstrated, it will proceed to fix reasonable rates and order them to be collected contingent upon the completion of the reconstruction ordered. It holds that, where the facts show that utility patrons are not getting prompt and speedy service, the state should require it. The matter came before the commission on an application of the Chamber of Commerce of Scottsbluff to require the Platte Valley Telephone Company to substitute common-battery for magneto service and for the commission to fix reasonable and proper rates therefor. The company was cited to appear and asked for a schedule of rates 60 per cent more than the magneto schedule, though the commission cut this schedule materially. The commission also went on record as holding that rates charged in other cities of like size are not to be considered as highly pertinent evidence of what is a reasonable rate for the town under investigation and that little importance attaches to such comparisons when unaccompanied by any information as to the differing factors of service.

POWER OF STATE OVER WATER RIGHTS.—The policy adopted by the Tennessee Railroad and Public Utilities Commission in asserting the right of that state to a voice in the disposition of water rights on navigable streams (referred to at length in the ELECTRICAL WORLD for Oct. 22, page 858) was embodied in a commission order now available. In this order the following statements, as condensed by *Public Utilities Reports*, were made: Although the economic progress of Tennessee has been retarded by neglect of water-power development, the rights of the people of the state to the benefits thereof can be protected only by writing into certificates of necessity and convenience appropriate provisions for accomplishing this end. The state commission is fully vested by law with the power to protect the interest of the people of the state in their natural resources from exploitation by private interests through the medium of its discretion in the issuance, denial or restriction of certificates of convenience and necessity. The state commission is empowered by law to prevent a utility from including in its rate base a separate element of water-power value for which it has paid nothing and on which the patrons of the utility would be required to pay rates. The full and absolute control of the sovereign state over the establishment and operation of its water powers is subject only to the limited constitutional powers of the federal government "to regulate commerce with foreign nations and among the several states." Under the commission's interpretation of the federal water-power act provision, requiring applicant utilities to the federal commission to comply with the requirements of the state, no development of any water power can be made without the approval and consent of the state commission as to the whole project, its regulation and operation.

COMMISSION ASSERTS RIGHT TO REQUIRE UTILITY TO DEVELOP REVENUE-PROMISING FACILITIES.—In the operation of a public utility, where it is demonstrated that the rates and charges are exceptionally high but at the same time necessary for the realization of a fair return on capital invested, the Oregon Public Service Commission reserves the right to suggest, and even order, the development of additional facilities from the operation of which more revenue may be earned. This is the substance of a decision of the department in which the Public Water Company, of southern Oregon, is directed to make a survey of the possible development of a certain water power in order that the revenues from the sale of such power may be reflected in a general reduction of rates to both old and newly acquired customers. The Public Water Company is engaged in the business of providing water for the irrigation of five thousand acres of land. The matter of rates came before the commission on petition of the farmer-users. The department said, in part: "Our engineers have made an examination of the utility property and have called the management's attention to the existence of certain potential water power at what is known as 'Bradshaw's Drop.' It is the duty of the utility in equity to its consumers to expend every endeavor to increase its revenues wherever possible. Apparently no effort has been made to develop or dispose of this power, which in our opinion would be a source of considerable revenue. Obviously good business management would have required this to be done long before."

Recent Court Decisions

SELECTION OF TEMPORARY LOCATION FOR TRANSMISSION LINE DOES NOT BIND COMPANY TO CONTINUE IT.—Sustaining an order of the Public Service Commission of Pennsylvania affecting the Counties Gas & Electric Company, the Pennsylvania Superior Court (90 Pa. Super. Ct. 570) has determined that the temporary location of a transmission line under a year's agreement with the property owner pending decision as to a permanent location does not bar a utility from condemning other property along a different route upon the subsequent determination of a permanent relocation. The selection of a route for transmission lines is a matter for a utility in the first instance, the court says, and the commission should not withhold its approval unless it is shown that it exercised its power wantonly, corruptly or capriciously, or that the rights of property owners have been trifled with or disregarded. The use of a temporary route for a transmission line under contract agreement for a year gives after that time no greater rights than if the agreement had never been made, and regular condemnation proceedings must be had to make the location permanent. (For abstract of commission's ruling see ELECTRICAL WORLD for Oct. 29, page 910.)

INSTRUCTION THAT COMPANY WAS LIABLE FOR NEGLIGENCE IN MANAGEMENT OF DAM NOT AN ERROR AS MAKING IT INSURER.—Orr vs. Arkansas Power & Light Company was an action to recover damages for injury to a corn crop by the flooding of land through the defendant's action in opening the gates of a dam. It was contended that an instruction given to the trial jury that plaintiff could recover if the defendant negligently raised the gates was erroneous as making the company an insurer, but this contention was overruled by the Arkansas Supreme Court, on the ground that whatever the company's rights were with reference to operating the dam, it could be held liable for damages due to negligence. A jury verdict for the plaintiff was, however, reversed by the Supreme Court because of the admission of hearsay evidence concerning declarations by the man who as the company's agent raised the gates. (298 S.W. 1029.)

DAMAGES REFUSED WHERE WIRING WAS ALTERED BY COMPANY EMPLOYEE KNOWN TO PLAINTIFF TO HAVE NO RIGHT TO DO SO.—Reversing judgment for the plaintiff in Ratliff vs. Kentucky & West Virginia Power Company, a suit for damages because of the destruction by fire of a house owing, as alleged, to faulty wiring for which the company was responsible, the Court of Appeals of Kentucky held that a directed verdict for the defendant should have been ordered by the trial judge. It based this finding on evidence that changes in the wiring were made by a company employee at the solicitation of the customer despite the facts that employees were forbidden to do wiring and that the plaintiff knew this. The sole ground of negligence as urged by the customer thus fell to the ground. None the less, the higher court pointed out, an electric light company sending energy into wires and fixtures its agents know to be defective is liable for damages even though it does not own the installation and has no duty to inspect it. A suit, the court implied, could properly be brought alleging negligence on the ground just stated. (299 S.W. 166).

CANADIAN POWER COMPANY LOSES IN WATER DIVERSION SUIT.—Judgment has been handed down in the Supreme Court of Ontario in a water diversion case between the Keewatin Power Company and the Lake of the Woods Milling Company, the decision being entirely favorable to the latter. The action began when the Keewatin Power Company sought an injunction against the Lake of the Woods Milling Company restraining defendant from diverting water from the Lake of the Woods through the plaintiff's land and premises and from other interference with the plaintiff's alleged rights. Unstated damages were also claimed on account of the water diversion, which plaintiff claimed had seriously impaired its water power. The decision is to the effect that the Lake of the Woods Milling Company is entitled to water up to the capacity of the canal in 1894. The court was unable to decide, on the evidence submitted, whether the capacity increased between 1894 and 1916, and so it allowed the plaintiff to submit within 30 days a reference to this point and to the damage it may have suffered from any enlargement of capacity that may be proved. The burden of proof will rest on the Keewatin Power Company. If no reference is taken, the action will be entirely dismissed.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

Pettyjohn Vice-President American Waterworks

James B. Pettyjohn, assistant cashier of the W. B. Worthen Company, bankers of Little Rock, Ark., has been elected a vice-president of the American Water Works & Electric Company, with headquarters in New York, and will assume charge of the operating department Jan. 1. Mr. Pettyjohn's business interests have been centered in Little Rock since 1915, when he became assistant manager of the Arkansas Water Company. He assumed the duties of the position he is now leaving seven years ago. Mr. Pettyjohn was born in Birmingham, Ala., and received his technical education at the Virginia Polytechnic Institute. Following graduation he returned to his native city and entered the employ of the Birmingham Waterworks, a subsidiary organization of the American Water Works & Electric Company.

OSWALD DALE, a member of the Wannamaker Institute of Industries and head of the radio sales department of the Acme Wire Company, New Haven, Conn., was elected vice-president of the Wheeler Insulated Wire Company, Bridgeport, Conn., at a recent meeting of the board of directors. Mr. Dale will continue to act as consulting engineer of the Acme Wire Company. Arthur Slepian, formerly assistant to D. S. Starring, general manager of the company, was elected secretary of that organization. Mr. Slepian has been with the Wheeler company two and one-half years and is a graduate of Harvard and the Massachusetts Institute of Technology.

R. T. FLEMING will join the staff of the insulating varnish department of Pinchin, Johnson & Company, Ltd., General Buildings, Aldwych, London, on Jan. 1. Mr. Fleming has had a unique experience in the field of research covered by electrical insulation. He worked in the research department of the British Westinghouse Company, Ltd., Trafford Park, and subsequently in the more fully equipped laboratories of the Metropolitan-Vickers Electrical Company, Ltd., and was in charge of the high-tension side of this work, having testing facilities up to a pressure of 500,000 volts.

HALLER D. SEAVEY has been appointed director of public relations of the Western Massachusetts Companies, with headquarters at Springfield, Mass. Mr. Seavey has been in charge of the construction and operation of transmission and distribution lines on the system of the Turners Falls Power & Electric Company for the last 22 years, with headquarters at Greenfield, Mass. In recent years he has also represented the utilities of this group in the public relations field and has played an active part in civic affairs in the middle Connecticut Valley area. Mr. Seavey is widely known in the transmission engineering field and has lately been retained as consultant in a number of appraisal cases and line-construction problems affecting New England utilities.

J. A. Bennan Heads Chicago Fuse Company

John A. Bennan, who is well known in the electrical industries through his development of the Jefferson Electric Manufacturing Company of Chicago from a humble beginning to its present position of prominence, has been

J. A. BENNAN

elected president and general manager of the Chicago Fuse Manufacturing Company. He is succeeding W. W. Merrill, who has retired after a 30-year period of guiding the destinies of this company. Mr. Bennan retains his connection with the Jefferson Electric Manufacturing Company in the capacity of president.

Mr. Merrill's affiliation with the Chicago Fuse organization dates back to 1894, and he has occupied successively the positions of bookkeeper, cashier, secretary, assistant treasurer, treasurer, vice-president and general manager and, finally, president.

LEA PIERSON, for several years new-business manager for the Kansas Electric Power Company at Leavenworth, Kan., has been made manager of that company's interests at Council Grove, succeeding R. C. STALLINGS, who resigned to establish an electrical contracting firm at Parsons. Mr. Pierson began his service with the company at Emporia and until his appointment to Leavenworth was head of the securities department of the company at the headquarters office at Lawrence.

Link-Belt Appoints Four Vice-Presidents

George P. Torrence has been appointed a vice-president of the Link-Belt Company of Chicago, with headquarters at Indianapolis, in general charge of Indianapolis operations and sales of Indianapolis plant products. George L. Morehead has been named a vice-president in charge of Eastern operations and sales, with headquarters in Philadelphia, and Frank B. Caldwell has been named a vice-president in charge of the Chicago plant and sales offices tributary thereto. W. C. Carter has been appointed a vice-president in general charge of production at all plants, with headquarters at the general offices of the company in Chicago.

RALPH A. JOHNSON has been appointed manager of the power sales department of the Lowell (Mass.) Electric Light Corporation, succeeding Percy J. Wilson, who resigned last summer to join the Narragansett Electric Lighting Company at Providence, R. I. Mr. Johnson has recently been assistant engineer of the American Woolen Company, and previous to a term of service as sales engineer of the Westinghouse Electric & Manufacturing Company he was employed by the Lowell company and the Savannah (Ga.) Electric Company, both being under Stone & Webster executive management.

EDWIN FLEISCHMANN has been added to the technical staff of the Buffalo, Niagara & Eastern Power Corporation. He was formerly connected with the heating unit division of the Westinghouse Electric & Manufacturing Company. Mr. Fleischmann will act as consultant for customers regarding the most satisfactory equipment and methods of electrical heat treatment in industry.

C. P. COUCH of Dallas, Tex., vice-president and general manager of the Southern Ice & Utilities Company, has been elected a director of the Bankers' Trust Company, Little Rock, Ark., to fill the vacancy caused by the death of Col. H. L. Remmel in October. Mr. Couch has been associated with his brother H. C. Couch in the construction of many plants and transmission lines of the Arkansas Power & Light Company for many years.

WILLIAM F. FRISCH, superintendent of the transformer division of the Fort Wayne (Ind.) works of the General Electric Company, has been appointed division superintendent at the Pittsfield works to succeed the late L. A. Thompson. A native of Pittsburgh, Mr. Frisch took an electrical engineering course with the Westinghouse company, continuing with that organization until

1908, when he entered the employ of the Fort Wayne & Indiana Traction Company. He became connected with the General Electric Company in 1912 in the construction department, later becoming superintendent of the transformer division. During his period of service with this division he received a Coffin award for an automatic testing machine.

J. W. WHITE was elected a director and managing director of the Westinghouse Electric Company of Japan at a recent meeting of the board of directors of that organization. Mr. White enters his new work with a wide background of experience with the Westinghouse company, both in the United States and abroad, having been respectively general manager of the Japan Company, manager of the power section of the Detroit office and manager of the Westinghouse International Company of Cuba. The extent of Mr. White's new responsibilities will be appreciated in light of the fact that the Westinghouse Electric Company of Japan operates as a separate company, importing and contracting directly with clients in that country.

H. BOYD ATKIN, formerly connected with the operating department of the United Gas Improvement Company, Philadelphia, has affiliated himself with the Associated Gas & Electric System in the capacity of operating supervisor on the staff of the J. G. White Management Corporation. Mr. Atkin had previously been connected in an engineering capacity with the Philadelphia Suburban Gas & Electric Company, the Kingston (N. Y.) Gas & Electric Company, the American Gas Company and the Waukesha (Wis.) Gas & Electric Company. He was on the operating staff of the United Gas Improvement Company from March until November, 1927.

T. P. PFEIFFER, who has been connected with the advertising department of the Byllesby Engineering & Management Corporation since 1922, has been appointed manager of that organization's advertising division. Mr. Pfeiffer was formerly identified with the Louisville Gas & Electric Company for eight years.

GEORGE B. JOHNS, formerly connected with the Union Gas & Electric Company, Cincinnati, has now become assistant electrical engineer for the Associated Gas & Electric Company at Oneonta, N. Y.

JOHN T. SHEWMAKE, formerly in charge of the industrial service department of the El Paso (Tex.) Electric Company, has been transferred to Scottsbluff, Neb., as superintendent for the Western Public Service Company.

JAMES SIMPSON, president of Marshall Field & Company, has been elected a director of the Commonwealth Edison Company, Chicago, to fill the vacancy caused by the death of John J. Mitchell.

Judge Davis Directs Joint Committee Work

Judge Stephen B. Davis has just returned to New York from Washington where for eight weeks he headed as vice-chairman, the active work of the International Radio Conference of 76 nations. Judge Davis is director of the Joint Committee of National Utility Associations, which correlates public relations matters and broad executive policies of the national electric lighting, electric railway and gas associations. He was selected for this position by George B. Cortelyou, chairman of the joint committee, and other leaders of the industry who were familiar with his distinguished work in the Department of Commerce.

For a number of years Judge Davis has been next to Mr. Hoover in the administration of the Commerce Department, holding the title of solicitor and serving as Acting Secretary of Commerce at all times during the many absences of Mr. Hoover from Washington. Under Judge Davis' personal supervision have come also the bureaus of Foreign and Domestic Commerce, Fisheries, Lighthouses and Steamship Regulations, the Patent Office, and particularly radio matters, which Judge Davis handled personally prior to the breakdown of the law in 1926. As a result Judge Davis is undoubtedly the outstanding authority on the legal aspects of radio. His book on "The Law of Radio," which has won several awards as the classic of the subject, was published by the McGraw-Hill Book Company this year.

C. H. KRETZ, vice-president of the Public Service Company of Oklahoma and general manager of the company's properties and affairs in the Okmulgee district, has been transferred, temporarily, to Kansas City to take charge of the operations of the City Ice Company, another subsidiary of the Middle West Utilities Company. Mr. Kretz retains his status as vice-president of the Oklahoma company but is giving up his managerial duties at Okmulgee. He removed to Okmulgee in 1914 and was vice-president and general manager of the Oklahoma Power Company for several years prior to the recent consolidation of that company with the Public Service Company of Oklahoma.

LYNWOOD W. GRAY of Fort Valley, Ga., has been appointed agricultural engineer of the Georgia Power Company. Prior to his farming activity, which has been of eight years' duration, Mr. Gray was a radio engineer in the United States Army, and before that association he spent eight years with the Georgia Railway & Power Company as power salesman. He is a graduate of the Alabama Polytechnic Institute in electrical engineering.

HENRY I. HARRIMAN, a trustee, has been elected vice-president of the Massachusetts Utilities Investment Trust. Mr. Harriman is also president of the New England Power Company and vice-chaiman of the board of the New England Power Association.

HARVEY HUBBELL, JR., was elected president and treasurer of Harvey Hubbell, Inc., Bridgeport, Conn., at a meeting of the board of directors, held Dec. 27, to succeed his father, the late Harvey Hubbell, Sr. For a number of years Harvey Hubbell, Jr., has been associated with his father in the management of the business.

D. E. BLANDY has been appointed rural service manager of the commercial department of the New York Power & Light Corporation, with headquarters at Albany. He will direct activities in connection with the promotion of rural business.

GEORGE R. MITTEN, formerly industrial development engineer of the Public Service Company of Northern Illinois, has been appointed sales promotion manager in general charge of all personnel, activities and facilities concerned in industrial development, sales promotion, sales research and sales advertising. A graduate of Purdue University, Mr. Mitten was with the General Electric Company for two years prior to the World War, and he became associated with the Public Service Company of Northern Illinois in 1919, following discharge from military service, in the capacity of power salesman. In 1925 he was appointed industrial development engineer, the position he held until his recent assignment.

JOHN S. KEEFE has been named president of the American Steel & Wire Company to succeed the late William P. Palmer. Mr. Keefe has been connected with the company since 1899 and has occupied the position of vice-president and been a director for 27 years.

E. D. MURRAY, formerly connected with the Coast Counties Gas & Electric Company, Santa Cruz, Cal., has joined the staff of the California Railroad Commission.

Obituary

SENTER M. JONES, first vice-president, manager of purchases and member of the executive committee of the Century Electric Company, St. Louis, died suddenly Dec. 11 at the age of 47. Having entered the organization in 1906, he always took a keen interest in employee activities and was highly esteemed by his associates. Besides being a member of the American Institute of Electrical Engineers, the St. Louis Electrical Board of Trade and the St. Louis Chamber of Commerce, he was a generous participant in civic and charitable organizations.

Financial and Statistical News

Markets Quiet but Firm Prices at Record Levels Money Rate 5 1/2 per Cent

MARKET activity has more or less tapered off during the last week of the year, although prices are well maintained at levels close to the peak. The year closes with much greater strength in power and light issues than some had predicted, and the same may be said of the markets in general. If market trends are still regarded as antecedents of corresponding business movements, 1928 should be a very prosperous year in the United States.

The ELECTRICAL WORLD index of the common stocks of fifteen representative light and power companies advanced one point over the figure recorded for last week. Substantial gains were made during the week by the Brooklyn Edison Company and by the Consolidated Gas Company of New York.

The call money rate—5½ per cent—was the highest of the year and compares with a rate of 6 per cent at the end of last December. The rise was regarded as a purely seasonal development.

Duquesne Light Company Refunds Preferred Issue

The sale of new securities for the purpose of refunding a higher-priced issue is by no means confined to bond financing. One of last week's larger issues was a $20,000,000 flotation of 5 per cent cumulative preferred stock sold by the Duquesne Light Company for refinancing purposes.

The issue to be replaced in this instance is a $30,000,000 issue of 7 per cent cumulative first preferred stock, series A. This issue is callable at 115 and dividends and will be called for redemption in March. It was sold in 1923-24, when money was still at high levels. Half of the total was sold at 103 and the balance at 106. The new issue of 5 per cent stock was issued at 97½ and accrued dividend to yield 5.12. While the issues do not coincide in amount, it is evident that a substantial annual saving is effected. In the refinancing operation the new preferred issue is supplemented by the proceeds from the sale of junior stocks of the company to the Philadelphia company.

The current piece of financing is the third for Duquesne Light Company this year. In April the company sold one of the early 4½ per cent bond issues—a $55,000,000 issue of first mortgage bonds for the purpose of retiring two issues bearing 5½ and 6 per cent rates. In October a $10,000,000 issue of first mortgage bonds was sold to reimburse the company for additions and extensions to property, etc. This issue also bore a 4½ per cent interest rate and was sold at 99.

It is thus apparent that the Duquesne Light Company has financed its current needs and reduced its annual fixed charges greatly, on very advantageous terms.

October Revenue 6 Per cent Higher Than in 1926

Earnings $150,800,000 and Energy Output 6,552,000,000 Kw.-Hr. —Purchase of Energy for Resale Virtually Stabilized

EARNINGS of $150,800,000, operating expenses of $64,500,000, an energy output of 6,552,000,000 kw.-hr. and the purchase of about 1,310,000,000 kw.-hr. for resale are indicated by October returns received by the ELECTRICAL WORLD from electric light and power companies throughout the United States. All these figures, except operating expenses, are about 6 per cent higher than those for October, 1926, and, therefore, higher than for any October in the history of the industry. Operating expenses rose less than 4 per cent.

It was noted that the September revenue, more than 9 per cent higher than last year, marked the attainment of the estimated normal, based on growth during the preceding five years, for the first time in 1927. Since the base period happened to end with two years of more than average business activity, namely, 1925 and 1926, the rate of growth indicated by it necessarily exceeds the long-time trend; the so-called normal established by the years 1922 to 1926 can, therefore, scarcely be regarded as attainable for any great length of time. Departure from it began, in fact, several months before the opening of 1927 and continued through the first eight months of the present year. The increase of September over August was greater this year than last in all parts of the country except New England, and thus brought a high total. Unlike September, October revenue fell short of the esti-

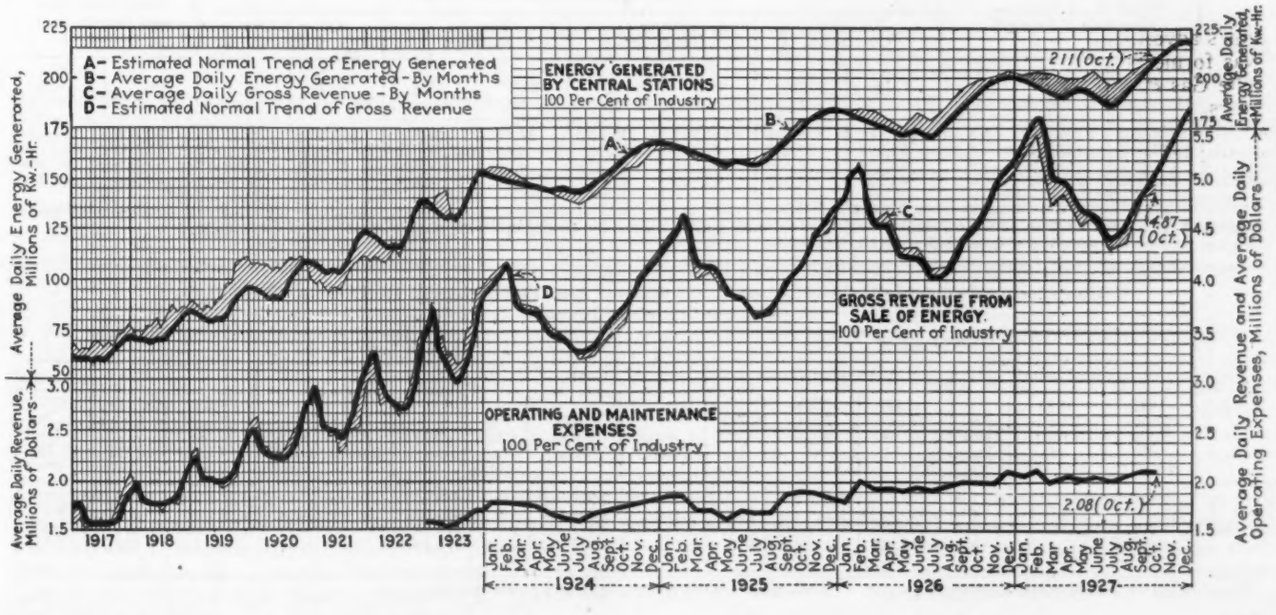

A- Estimated Normal Trend of Energy Generated
B- Average Daily Energy Generated - By Months
C- Average Daily Gross Revenue - By Months
D- Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
211 (Oct.)
4.87 (Oct.)
2.08 (Oct.)
Average Daily Energy Generated, Millions of Kw.-Hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1917 1918 1919 1920 1921 1922 1923
1924 1925 1926 1927

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 Per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly*			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1927 Thousands	1926 Thousands	Per Cent Inc.	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands
July....	6,109,472	5,562,172	+9.8	5,028,472	4,489,172	1,242,000	1,164,000	3,262,472	2,808,172	524,000	517,000	1,081,000	1,073,000	1,178,000	1,010,000
Aug....	6,335,335	5,777,753	+9.6	5,217,335	4,663,753	1,265,000	1,212,000	3,425,335	2,932,753	527,000	519,000	1,118,000	1,114,000	1,290,000	1,122,000
Sept....	6,262,338	5,825,852	+7.5	5,152,338	4,701,852	1,274,000	1,188,000	3,367,338	3,009,852	511,000	504,000	1,110,000	1,124,000	1,287,000	1,210,000
Oct....	6,552,439	6,174,959	+6.1	5,394,439	4,981,959	1,372,000	1,262,000	3,466,439	3,171,959	556,000	548,000	1,158,000	1,193,000	1,310,000	1,240,000

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only

mated normal, and so was more in line with earlier months. As before, the change seems to have been nation-wide. An increase from September to October is seasonal, but in every section the increase was smaller this year than last. In New England it was 7 per cent against 11 per cent last year; in the Atlantic States, 5.5 against 9; in the North Central, 3 instead of 5.2; in the South Central, 2.5 against 9, and in the Far West, which has seasonal variations peculiar to itself, there was a decrease in 1926, rising to 1.2 per cent in 1927.

But if the change from September was smaller than last year, it was, nevertheless, an increase, not only over the preceding month, but also over the corresponding month of 1926 and in that respect was in accord with the characteristic upward trend of the industry. As in other recent months, the greatest regional rate of increase compared with the corresponding month of 1926 is reported from the South Central States, where it amounted to 17 per cent, although all regional totals are larger than last year.

Operating expenses moved with revenue, on the whole, though the changes were smaller and the net earnings, therefore, improved more than the gross.

In energy output the excess over the corresponding month of 1926 was, in general, slightly smaller than in September. Active gains continued in the West South Central States (18 per cent), in the South Atlantic States (14 per cent) and along the Pacific Coast (9 per cent).

Purchase of energy for resale has for three months varied only slightly from 1,300,000,000 kw.-hr. During most of 1926 it was around 1,000,000,000 kw.-hr. monthly; in the latter part of that year it rose about 20 per cent, and throughout 1927 has ranged between 1,200,000,000 and 1,300,000,000. The inference may be drawn that new interconnections are now quite well estalished, at least for the present, and that the movement of large blocks of energy between companies has become essentially stabilized, though the construction of additional lines will, no doubt, be attended by a gradual increase in that movement, which now exceeds a fifth of the energy generated.

Energy is purchased by an operating company only when purchase is more economical than generation, or when the supply is temporarily inadequate to meet the demands of the load; for example, when water power is insufficient. Such a transaction, therefore, indicates that adjacent systems are effectively serving as a standby to one another in time of need; it connotes economy either of installation or of fuel consumption.

Notwithstanding an increase in the amount of energy generated from fuel, the consumption of coal was less than in October, 1926; the use of fuel oil decreased by almost half; natural gas alone increased, but, as this constitutes less than 5 per cent in fuel value, the change in the aggregate shows increasing efficiency in power production.

TABLE II—OPERATING RATIO OF CENTRAL-STATION COMPANIES

Month	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Hydro and Steam Plants	
	1927	1926	1927	1926	1927	1926
July..	51.3	52.3	34.2	33.4	44.3	46.4
Aug..	52.8	53.6	34.6	36.3	44.1	45.8
Sept..	48.8	49.7	33.4	37.5	42.1	43.3
Oct..	46.9	48.3	31.8	32.4	42.6	43.9

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR FOUR MONTHS IN THE UNITED STATES
(100 Per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1927 Thousands	1926 Thousands	Per Cent Inc.	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands
July.....	$134,500	$125,700	+7.0	$77,900	$76,000	$41,900	$36,300	$4,500	$4,500	$10,200	$8,900	$62,400	$59,900
August..	135,600	126,400	+7.3	79,900	77,900	41,400	35,900	4,400	4,300	9,900	8,300	63,000	60,200
Sept....	144,900	132,600	+9.3	84,500	80,500	44,600	38,000	4,600	4,500	11,200	9,600	63,700	60,300
Oct.....	150,800	141,800	+6.3	88,700	84,100	45,800	42,000	4,600	4,600	11,600	11,100	64,500	62,200

†Aggregate gross revenue from actual consumers and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES*
(100 Per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro-Plants			Fuel Power Plants			Coal			Oil			Gas		
	1927 Thousands of Kw.-Hr.	1926 Thousands of Kw.-Hr.	Per Cent Increase	1927 Thousands of Kw.-Hr.	1926 Thousands of Kw.-Hr.	Per Cent Increase	1927 Short Tons	1926 Short Tons	Per Cent Increase	1927 Barrels	1926 Barrels	Per Cent Increase	1927 Thousands of Cubic Feet	1926 Thousands of Cubic Feet	Per Cent Increase
July.....	2,401,852	1,971,199	+21.8	3,707,620	3,590,973	+ 3.2	2,996,291	2,993,960	+0.7	449,903	671,984	—33.1	5,598,713	5,056,094	+10.7
August....	2,371,572	2,062,629	+14.9	3,963,763	3,715,124	+ 6.7	3,180,358	3,060,647	+3.9	480,022	728,864	—34.1	6,259,785	5,403,316	+15.8
September.	2,167,863	2,033,312	+ 6.6	4,094,475	3,792,540	+ 7.9	3,240,986	3,114,535	+4.1	478,302	883,913	—45.9	6,414,849	4,816,955	+33.1
October....	2,339,851	2,122,336	+10.2	4,212,588	4,052,623	+ 3.9	3,327,273	3,317,113	+0.3	478,747	879,929	—45.6	6,402,952	4,872,740	+31.4

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

AMERICAN & FOREIGN POWER TO FINANCE EXPANSION PROGRAM.—The American & Foreign Power Company, Inc., organized in 1923 and controlled by the Electric Bond & Share Company, is planning to obtain $126,151,400 of additional capital for the purpose of carrying forward an extensive program of expansion in foreign countries along modern American lines. This new capital will be provided by the sale of units of securities consisting of one share of seven-dollar second preferred stock and four option warrants to purchase common stock, both such stock and option warrants to be in the form which the company has previously issued. Ownership of these securities will be evidenced in the first instance by allotment certificates upon which an initial payment of 40 per cent must be made at the time of subscription. Subsequent installments of not more than 10 per cent may be called for at intervals of not less than three months, with the right, at the subscriber's option, to anticipate any or all calls at any time. The first right to subscribe to these securities will be offered to the holders of the company's second preferred stock, common stock and option warrants at the price of $100 per unit.

PACIFIC GAS & ELECTRIC TO INCREASE CAPITAL.—Power and light company capitalization is beginning to run into high figures. Directors of the Pacific Gas & Electric Company recently voted to increase the capitalization from $160,000,000 to $400,000,000, subject to approval of the shareholders and the California Railroad Commission. The increase adds $120,000,000 to the authorized preferred stock and a similar amount to the authorized common shares.

NEW $20,000,000 LOAN FLOATED.—Convertible debentures of the Central States Electric Corporation were offered the investing public on Dec. 28 to the amount of $20,000,000, the price being 96½ and interest to yield 5.28 per cent. These 5 per cent securities were dated Jan. 1, 1928, and mature Jan. 1, 1948. Proceeds are to be used to liquidate indebtedness incurred in connection with the acquisition of stocks, to acquire additional investments and to redeem funded debt. During the week under review the Central Gas & Electric Company issued 25,000 shares of preferred stock at $94.50 and accrued dividend per share, to yield over 6.87 per cent. This company last week made two new offerings, as announced in the Dec. 24 issue of the ELECTRICAL WORLD, one in the form of sinking fund gold bonds and the other in the form of gold notes. Proceeds of the new issue will be used to acquire new properties to retire debt and for other corporate purposes.

MASSACHUSETTS UTILITIES TRUST INCREASES BOARD AND EXECUTIVE COMMITTEE.—At a meeting of the trustees of the Massachusetts Utilities Investment Trust the board of trustees was increased from 34 to 35 by the addition of George Bramwell Baker, of Baker, Young & Company. The trustees also elected as new members of the executive committee Arthur E. Childs, Philip M. Childs, James J. Phelan, Charles L. Edgar and Frank D. Comerford. The present executive committee comprises the above and Merton E. Crush, Henry I. Harriman, Harold B. Lamont, Chauncey D. Parker, Elwin G. Preston, Bowen Tufts and Paul B. Webber. The trustees voted to authorize an increase in the number of preferred shares to provide for capital requirements during 1928. These shares will be offered to preferred and voting-trust common shareholders when issued.

NORTHERN STATES POWER RIGHTS.—Northern States Power Company officials announced this week that holders of class A common stock will be offered the privilege of subscribing to additional class A stock at $100 a share to the extent of one-fourth of their holdings as of Jan. 3. Holders of class B stock are offered similar rights to subscribe to class B stock on the same basis. For this purpose the directors have authorized the issuance of additional stock at the proportions specified.

Public Utilities Largest Borrowers*

Their 1927 Borrowings Were $400,000,000 More than in 1926 —Further Downward Trend in Interest Rates Is Seen to Be Indicated

BY C. W. SILLS
Vice-President Halsey, Stuart & Company, Inc.

FOR THE fourth consecutive year the total financing in the American market has exceeded that of the previous year and also set a new high peace-time record for volume. When the final figures for 1927 are tabulated, the grand total of corporation and government financing will prove to have been well over $9,000,000,000—perhaps $9,500,000,000. This 1927 grand total was at least 20 per cent above the previous record set in 1926. But, more significant still, it exceeded the five-year average (1922 to 1926) by almost 50 per cent.

The public utilities are at present the largest borrowers of capital. In 1927 the electric, gas, water, telephone, street railway and other public utilities found it necessary to put approximately $1,190,000,000 of new capital to work. When we include also their large refunding operations for the year, the total utility bond financing approaches the $2,000,000,000 mark and is around 24 per cent of the total bond financing undertaken in the country.

The utilities increased their borrowings in 1927 over 1926 by nearly $400,000,000. In spite of this, however, their total for each year was approximately the same percentage of the grand total of bond financing in the country. It is recognized by all who are familiar with things financial that the public utilities have been growing faster than the average of all industries, and that for some time at least they will continue to need a very large amount of capital—for the expansion of present services, for replacements and for interconnecting present systems. There is, however, a growing tendency among the public utilities to secure a somewhat greater share of their necessary funds through stock financing. In 1926 approximately 25 per cent of their new capital was secured this way, while in 1927 29 per cent came through the sale of stock.

Let us summarize the borrowing side of the bond market. It tends to divide itself into three groups: (1) Those classes which may be expected to increase their reliance on the bond market and demand more funds from year to year, this being a very limited group, confined to certain lines in the industrial field; (2) those classes which may be expected to continue their present relative demand for long-term funds, this including the public utilities, the railroads and possibly the foreign group; (3) those which are likely to furnish a decreasing volume of opportunity for investment, where we find the municipals, the farm-loan borrowers and real estate.

There is substantial reason for believing that, in sum total, the three groups will tend to cancel each other's variation from the present volume of demand for long-term financing. At least it does not seem probable that the recent rapid expansion of long-term borrowing will continue at such a record-breaking pace.

On the other hand—the lending side of the picture—it appears that the supply of new surplus capital seeking investment can hardly fail to continue to accumulate in a volume which assures at least a plentiful supply for all legitimate borrowing. Over a period of nearly seven years now the supply of loanable funds in this country has been accumulating somewhat faster than the demand for them at current interest rates. The result has been that lenders and investors have been compelled to accept a constantly diminishing rate of return in order to find a market for their whole surplus. Interest rates, in consequence, have seen a gradual decrease, and bond prices have advanced proportionately.

All the present trend in industry is toward more economy and efficiency in production and marketing, with narrower margins of profit but increasingly greater volume of total output.

*From an article entitled "Present Tendencies in the Bond Market."

This sort of development—barring unexpected disturbances of a severe nature—will, doubtless, increase the surpluses of wealth in the country, and thus of savings available for investment. In addition, the surplus coming to us from abroad as interest and profits on our investments in foreign countries is practically certain to grow in volume as our loans and other investments increase. So much for the general surplus of loanable wealth.

Our supply of gold in America is now being somewhat reduced by remittances to foreign centers, but little or no fear is felt that this supply will decrease in such extreme volume as to handicap our currency facilities. Moreover, as these foreign nations and customers of America become more firmly established in their currency stabilization by those new additions to their gold supply, it is to be expected that positive benefits will accrue to our own trade and our own prosperity.

The financial and general credit situation in the United States is in a particularly sound and healthy condition and able to facilitate all the normal financing which the market may demand. Hence, with the trend of bond borrowing indicating no great acceleration in volume for the near future and the supply of surplus capital apparently increasing—as for several years past—somewhat faster than this demand, it is difficult to conclude otherwise than that the trend of interest rates will continue downward through the coming year, with a corresponding rise in the level of bond prices.

NEBRASKA LIMITS ORGANIZATION OF INVESTMENT TRUSTS.—Investment trusts organized on the plan of no par stock and with voting power restricted to one class of stock cannot be allowed to sell their securities in Nebraska, under a ruling of the Attorney-General transmitted to Jesse V. Craig, head of the State Securities Bureau. The Attorney-General says that where the articles also permit the trust to borrow or otherwise raise money without limit they violate the constitution of Nebraska, which places a limitation upon the indebtedness of corporations. He maintains that the constitution requires all stock sold in the state to have a face value and that all stock shall be of equal voting power, and, as these provisions bind domestic corporations, the constitutional proviso that forbids granting of greater rights to foreign corporations applies with prohibitive force.

CALGARY POWER PAYS INITIAL DIVIDEND.—Directors of the Calgary Power Company, Ltd., supplying power to various municipalities in the Province of Alberta, have declared a dividend of 1¼ per cent on the company's common stock, payable Dec. 31, for the quarter ending that date to shareholders of record Dec. 23, 1927. This will be the first dividend distribution made on the stock. The Calgary Power Company holds under lease from the Dominion government all the water power of the Bow River at Horseshoe Falls and Kananaskis Falls, Alberta, and has a developed hydro-electric generating capacity of about 31,500 hp.

ADIRONDACK POWER & LIGHT CALLS BONDS.—All of the outstanding $5,000,000 first and refunding mortgage gold bonds, series of 5 per cent, due Jan. 1, 1956, have been called for payment Jan. 1, at 105 and interest.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Dec. 27	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	147¾	83	147
Ala. Pwr., $7 com. pf.—no par	114	107	115
Allis-Chalmers Mfg., 6% com	117¾	88	118¾
Aluminum Co. of Amer., com	123	67¾	145¾
Aluminum Co. of Amer., 6% pf	105½	101¼	106¾
Amer. & Foreign Pwr., 7% pf.—no par	109	86	109¾
Amer. & Foreign Pwr., com.—no par	25½	18¼	31⅝
Amer. Bosch Magneto, com.—no par	21¼	13	26¾
Amer. Brown Boveri Elec.†	14½	5¼	39¼
Amer. Brown Boveri Elec., pf. $7	58¾	40	98
Amer. Gas & Elec., 6% pf.—no par	106½	95½	108¾
Amer. Gas & Elec., com. †—no par	121¼	68¼	125
Amer. Lt. & Trac., 6% pf	112	112	120
Amer. Lt. & Trac., new com	174	164¾	186
Amer. Pwr. & Lt., 6% pf	108¾	97¼	109
Amer. Pwr. & Lt., com. †—no par	66¼	54	73¾
Amer. Pub. Serv., 7% pf.	a 99	94	104
Amer. Pub. Serv., com. †	k 70	65	75
Amer. Pub. Utilities, 7% ptc. pf	87	73	90
Amer. Pub. Utilities, 7% pr. pf	94½	88	97
Amer. Pub. Utilities, com	k 60	65	70
Amer. States Sec., A	4¼	2¾	5½
Amer. States Sec., B	4¼	2¾	5¾
Amer. Superpwr., 6% ptc pf.—25	k 28¾	26¼	29½
Amer. Superpwr., 6% 1st pf	l 100	....	....
Amer. Superpwr., Class A†—no par	k 38¼	27¼	43
Amer. Superpwr., Class B†—no par	38¼	28¼	43
Amer. Wtr. Wks. & Elec., 6% pf	k101¾	99¼	103½
Amer. W.W. & E., com. new—no par	59¼	46	72¼
Anaconda Copper cap. $3	60	41¼	60¼
Appalachian Electric Pwr., 7% pf	106	100	109
Arkansas Pwr. & Lt. 7% pf	106¼	108	110
Assoc. Gas & Elec., $3.50—50	54	....	....
Assoc. Gas & Elec., pf.—$6—no par	97	85	98
Assoc. G. & E., Class A, 10—no par	49¼	35	52
BABCOCK & WILCOX, 7% com	122	113	132
Binghamton L., H. & P., $6 pf	102	93	103
Birmingham Elec., pf.—$7—no par	110	105	111½
Blackstone Valley G. & E., 6% pf	k107	103	110
Blackstone Valley Gas & Elec., 10% com.—50	k128	98	153
Blaw-Knox, com.†	i 98½	70	105
Brazilian Trac., Lt. & Pwr., com.†	f220	....	....
Broad River Pwr., 7% pf	104½	97	105½
Brooklyn Edison, 8% com	207¼	148¼	207¾
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	i 26	....	....
Buffalo, Niagara & East. Pwr. com. $1.20—no par	i 30½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf	k 99	96	104½
California Ry. & Pwr., 7% pf	k135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	109½	107	109
Central & S. W. Util., $7 pf.—no par	a 99½	92¾	99¼
Central & S. W. Util., pr. in. $7 pf.—no par	e104½	98½	104½
Central Ark. Ry. & Lt., 7% pf	104½	100	104
Central Ill. Pub. Serv., $6 pf	a 98	85½	98
Central Ind. Pwr., 7% pf	a 95	85½	95½
Central Maine Power, 6% pf	95	....	....
Central Maine Power, 7%	106	102	110
Central Pwr. & Lt., 7% pf	104	100½	105
Central States Elec., 7% pf	99	93	103½
Central States Elec., com.†	m 28¼	17¼	30¾
Century Elec., 6% com	b141	114	162
Chicago Fuse Mfg., com.—$2.50 no par	a 31	30	35½
Cincinnati Gas & Elec., 5% com	g100	96½	101¾
Cities Service, $6 pf.—no par	95½	87	94¼
Cities Service, pf. B—no par	8½	8	8¼
Cities Service, pf. BB—no par	88	80½	86
Cities Service, com.—20	55½	40½	58¼
Cities Service, Bks. Shrs.—10	27¼	22¼	27
Cities Service Pwr. & Lt., 7% pf	k104	97¼	108½
Cities Service Pwr. & Lt., 6% pf	k 94	90	96
Clarion River Pwr., 8% pf	m 95	....	....
Cleveland Elec. Illg., 6% pf	112	108	114
Cleveland Elec. Illg., 10% com	330	285	370
Columbia Gas & Elec., 6% pf	108½	99½	108¾
Columbia G. & E. com. $5—no par	92¼	82¼	98¼
Columbus Elec. & Pwr., $2 com.—no par	65	....	....
Columbus Elec. & Pwr., 7% pf	107	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf	107	98¼	106
Columbus Ry., Pwr. & Lt., 6½% pf. B	104	96	105½
Columbus Ry., P. & L. com.—no par	100	75	105
Commonwealth Edison, 8% com	a171	138	173
Commonwealth Pwr., 6% pf	k103	91½	103½
Commonw'th Pwr., $2, com.—no par	65½	48¼	78¼
Conn. Lt. & Pwr., 8% pf	118	119	123
Conn. Lt. & Pwr., 7% pf	112	112	119
Cons. Gas of N. Y., pf	k102½	93	103
Cons. Gas of N. Y., com. $5—no par	121	94	121¾
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf	e110½	110½	112¾
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf	e112½	110¼	114¾
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf	e115	112½	117
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf	e128	127	130½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par	e 68	51	71
Consolidated Pwr. & Lt., 7% pf	105	100	106
Consumers Pwr., 6% pf	104½	100	106½
Consumers Pwr., 6.6% pf	106	103	107½
Continental Gas & Elec., 8% ptc. pf	108½	103	110
Continental Gas & Elec., 7% pr. pf	106	100	107½
Conti. G. & E. com. $4.40—no par	k225	210	265
Crocker Wheeler, com.†	23	23	38
Crocker Wheeler, 7% pf	82	78	88
DALLAS PWR. & LT., 7% pf	110½	107	111½
Dayton Pwr. & Lt., 6% pf	108	101	109½
Detroit Edison, 8% com	164¼	133¼	168
Dubilier Condenser, com.—no par	3¼	2	5¼
Duke Pwr., cap	136	115	145
Duquesne Lt., 7% pf	115¾	114¼	117¾
EASTERN NEW YORK UTIL., $7 pf	k110¼	102	112¼
Eastern New York Util. com	k 65	70	75
Eastern States Pwr. $7, com	12¼	9	14
Eastern States Pwr., pf	97	90	99
East. Tex. Elec., 7% pf	107	106	109
Edison Elec. of Boston, $12 com	d265¼	217	267
El Paso Elec. 7% pf	110	105	112½
Elec. Bond & Share, 6% pf	109	105½	110½
Elec. Bd. & Sh. Sec., com. $1—no par	80	67¼	83¼
Electric Household Util.†	a 12¾	11	15¾
Elec. Investors, 6% pf.—no par	99¼	92	100½
Elec. Investors, com.†—no par	47⅝	32¾	47¾
Elec. Pwr. & Lt., ctfs. pf	107	96	109
Elec. Pwr. & Lt., ctfs., 40% pd	k121½	103¾	122½
Elec. Pwr. & Lt., ctfs., com.—no par	30½	16¼	32¾
Elec. Refrig. cap.†	9¼	5¾	37½
Elec. Ry. Securities, com.—no par	6¼	....	....
Elec. St. Battery com. $5.25—no par	76¼	63¼	81
Elmira Wtr., Lt. & R.R., 7% pf	k104	99	105½
Empire Pwr., ptc.†	28¼	26	39
Engr. Pub. Serv., $7 pf.—no par	107¼	93¾	108¾
Engr. Pub. Serv. com.—no par	35	21¼	39¼
Eureka Vacuum Cleaner, com. $4—no par	76¾	50	77¾
FAIRBANKS MORSE, 7% pf	k109	107	112
F.-M., com.—$3—no par	32¾	30¾	43¼
Federal Lt. & Trac., com $1.40	44	37¼	47
Federal Lt. & Trac., $6 pf.—no par	k 97¼	91¼	100
Florida Pwr. & Lt., 7% pf	105½	102¾	107
Ft. Worth Pwr. & Lt., 7% pf	113	108	114½
GALVESTON-HOUSTON ELEC. 6% pf	77	68	85
Galveston-Houston Elec., com	31	26	32
General Cable, Cl. A $1 no par	59¼	55¼	62¼
Gen. Elec. $3 com.—no par	132¾	81	146¾
Gen. Elec., special—6%	11¾	11	11¾
Gen. Gas & Elec. (Del.) com A $1.50—no par	36	34	47¼
Gen. G. & E. (Del.) pf. A $8—no par	k122½	113½	123¾
Gen. G. & E. (Del.) pf. A $7—no par	107	100	110½
Gen. G. & E. (Del.) pf. B $7	k103	96	105½
Gen. Pub. Serv., $7 cum. pf., no par	k110	102	112
Gen. Pub. Serv., com., no par	17¼	11¼	18
Ga. Ry. & Pwr., 8% pf	k125	119	125
Ga. Ry. & Pwr., 7% pf	k113¼	106	115
Gt. Western Pwr., 7% pf	l104	....	....
IDAHO PWR., 7% pf	108½	103	110
Ill. No. Utilities, 6% pf	a100½	....	....
Ill. Pwr. & Lt., 7% pf	103	99	104
Ingersoll Rand com	k 91	87¼	96¼
Int. Combus. Engr., com. $2—no par	57¼	40¼	64
Int. Combustion Engr., 7% pf	105½	101	105½
Int. Util., Class A—$3.50—no par	48¾	28	53
Int. Utilities, Class B—no par	9¼	3	11¼
Interstate Pwr., pf.—$7—no par	98	93	99
Interstate Pub. Serv., 7% pf	101¼	98	104
Iowa Ry. & Lt., 7% pf	k 98½	97	100
JERSEY CENTRAL PWR. & LT. CO., 7% pf	106	97¼	108
Johns-Manville. com.†—no par	120¾	55¼	126¼

Stock Exchange: cChicago; bSt. Louis; ePhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Dec. 24. lBid price Wednesday, Dec. 28. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Dec. 27	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf. $7	114¼	112	116
Kansas Gas & Elec., 7% pf.	107½	103	107½
Kentucky Hydro-Elec., 7% pf.	*a*104	94½	104
Kentucky Sec., 6% pf.	86	83	90
Kentucky Sec., 5% com.	115	100	120
Kentucky Utilities, 6% pf.	*k*100	95	101
LACLEDGE GAS LT., 12% com.	*k*200	173½	267½
Lehigh Pwr. Sec., com.—no par.	21	15	22
Long Island Ltg., 7% pf.	111	107	112
Long Island Ltg., com.†—no par.	170	139	180
Los Angeles Gas & Elec., 6% pf.	104	98	105
Louisville Gas & Elec., cl. A. $1.75	29½	23½	30½
MAN. ELEC. SUPPLY, cap. $5—no par	52	43	132
Manilla Elec., com.†—no par.	*k* 51	40	60
Maytag Mfg., com. .50—no par.	34½	23½	35½
Memphis P. & L., pf.—$7—no par.	*k*109½	107	111
Metropolitan Ed., pf.—$6—no par.	106	93	106
Metropolitan Ed., pf.—$7—no par.	109	104	110
Metropolitan Ed., com. $5—no par.	*k* 70	60	72
Middle West Utilities, 7% pf.	*a*118½	110½	119
Middle West Util., 7% pr. lien	*a*125½	117½	127
Middle West Util., com. $6—no par	*a*122	108	125
Midland Utilities, pr. ln. 6% pf.	*a*106	97½	107½
Midland Utilities, 7% pf. A	*a*100½	96½	103½
Milwaukee Elec. Ry. & Lt., 7% pf.	*k*102	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	*k* 98½	98	101½
Minn. Pwr. & Lt., 7% pf.	107½	104	107
Miss. River Pwr., 6% pf.	106	94	108
Miss. River Pwr., 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	106	100	109
Mohawk Hudson Pwr., 2d pf.—$7—no par.	114	100	109
Mohawk Hudson Pwr., com.—no par	30½	20½	32½
Montana Pwr., 5% com.	104½	81½	109½
Montreal Pwr., 7% com.	*f* 90	....	....
Mountain States Pwr., 7% pf.	103½	97	103
Mountain States Pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	110	98	110
National Carbon, 8% pf.	*a*136½	130½	139½
National Elec. Pwr., A†	*a* 27½	22	28½
National Lt., Ht. & Pwr., com.	*k* 24	20	30
National, Light, Ht. & Pwr., 5% pf.	*k* 72	70	80
National Pwr. & Lt., pf.—$7—no par	109½	101	111½
National Pwr. & Lt., com.†—no par.	23½	19½	26½
National Pub. Serv., 7% pf.	100½	93	102
National Pub. Serv., 7% ptc., pf.	114	108	115
National Pub. Serv., A com. $1.60—no par.	22½	18½	24
National Pub. Serv., B com.—no par	26½	14	30
Nebraska Pwr., 7% pf.	110	106	109½
Nevada-Calif. Elec., com.	*k* 34½	25	36½
New Brunswick Pwr., 4% pf.	*k* 60	60	70
New Eng. Pub. Serv., pr. ln. pf. $7	*k*103	98½	104
New Eng. Pub. Serv., pf. $7	*k* 98	95	100
New Orleans Pub. Serv.—7% pf.	108½	103	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	95	91	100
N. Y. Central Elec., 7% pf.	*k*103	101	104
New York Power & Light, 6% pf. no par	*m*102	....	....
New York Power & Light, 7% pf.	115	....	....
Newport News & Hampton Ry., Gas & Elec., 5% com.	*k*109	110	115
Newport News & Hampton Ry., Gas & Elec., 7% pf.	*k*109	110	115
Niagara Falls Pwr., 7% pf.—25	*k* 28½	27½	29½
Niagara, Lock & Ont. Pwr., 7% pf.	*k*115	110½	116
No. Amer., 6% pf.—50	53½	50	55
No. Amer., com.—10	60½	45½	64½
No. Amer. Edison, $6 pf.—no par	*k*104	96½	105
No. Caro. Pub. Serv., pf.—$7—no par	103½	93	105
Northeastern Pwr., com.	20½	14½	25
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par.	20½	9½	20½
No. Ont. Lt. & Pwr., 6% pf.	*k* 94	84	95
No. Ont. Lt. & Pwr., 4% com.	*k* 72	73	78
No. States Pwr. (Del.), 7% pf.	110	100½	110
No. States Pwr. (Del.), 8% com.	134½	109½	136½
No. Texas Elec., 6% pf.	45	45	70
No. Texas Elec., com.	10	5	36
OHIO BRASS, com. B $4—no par.	116	76	116½
Ohio Brass, 6% pf.	*k*110	100	111
Ohio Pwr., 6% pf.	105	96	104
Ohio Pub. Serv., $6 pf.	*k*101	95	102
Ohio Pub. Serv., 7% pf.	109½	103	111
Ohio River Edison, 7% pf.	108½	103	109½
Oklahoma Gas & Elec., 7% pf.	108	....	....
PACIFIC Gas & ELEC., 6% pf.	26½	24½	26½
Pacific Gas & Elec., 8% new com.	48½	31	50
Pacific Pwr. & Lt., 7% pf.	105	102	104½
Penn Cent. Lt. & Pwr., $5 pf.—no par.	*c* 79	75½	80
Penn-Ohio Edison, 6% pf. no par	*k* 90	78	91
Penn-Ohio Edison, 7% pf.	*k*107	97½	104
Penn-Ohio Elec., 7% pf.	*m*102	99	103
Penn-Ohio Pwr. & Lt., 7% pf.	108	99	110
Penn Pwr. & Lt.—$7—no par.	110	107	109
Penn Wtr. & Pwr., 8% com., new	*c* 73	47½	75
Phila. Co., 5% pf.-50	*k* 51	40	51
Phila. Co., 6% pf.—50	52½	50	53½
Phila. Co., com.—50	*k*140	85½	153½
Phila. Elec., 8% com.—25	*c* 56½	46½	58½
Portland Elec. Pwr., 7% pf.	102	97½	102½
Portland Elec. Pwr., 6% pf.	85	78	84
Portland Elec. Pwr., 6% 2d pf.	73	55	70
Portland Elec. Pwr., com.	33	22	30
Potomac Elec. Power, pf.	*m*111½	....	....
Pwr. Sec., pf.—no par.	*k* 56	28	60
Pwr. Sec., com.—no par.	*k* 12	5	15
Public Serv. of Colorado, 7% pf.,	106	99	103
Pub. Serv. of N. J., 6% pf.	104	98½	105
Pub. Serv. of N. J., 8% pf.	134½	125	135½
Pub. Serv. of N. J., $2 com.—no par	42½	32	46½
Pub. Serv. of No. Ill., 6% pf.	*a*113½	101½	113½
Pub. Serv. of No. Ill., 7% pf.	*a*120½	112½	120½
P. S. of No. Ill., com. $8—no par.	*a*159½	140½	161½
Pub. Serv. of No. Ill., $8 com.	*a*158½	132	161½
Pub. Serv. of Okla., 7% pr. ln.	*k*102	90	103
Pub. Serv. Elec. & Gas, 6% pf.	*k*109½	102	110½
Puget Sound Pwr. & Lt., 7% pf.	109	105	109
Puget Sound Pwr. & Lt., $6 pf.—no par.	91	83½	92½
Puget Sound Pwr. & Lt., com.	36	28	38½
RADIO COPR. OF AMER., $3.50 pf.—50	*k* 55	49	57
Radio Corp. of Amer., com.—no par.	94½	41½	101
Rhode Island Public Service, pf. $2—no par.	*m* 30½	28½	30½
Rochester Gas & Elec. 6% pf. D.	*k*105½	101	103½
Rochester Gas & Elec., 7% pf. B.	105½	105	107
Rochester Gas & Elec., 6% pf. C.	105	101½	103½
SAN JOAQUIN Lt. & Pwr., 7% pr. pf.	*k*111	105	112½
St. Joseph Ry., L., H. & P., 5% pf.	*k* 75	70	75
Servel Corp.	75cts	10cts	10½
Sierra Pacific Elec., 2% com.	27	24½	31½
Sioux City Gas & Elec., 7% pf.	106½	99	105½
Southeastern Pwr. & Lt., pf.—$7—no par.	*l*108½	....	....
Southeastern Pwr. & Lt., ptc. pf.	*l* 85	....	....
Southeastern Pwr. & Lt., com.—no par.	43½	29½	46
So. Calif. Edison, 8% pf.	*k* 40	36½	40
So. Calif. Edison, 7% pf.	*k* 28½	27	28½
So. Calif. Edison, 6% pf.	*k* 25½	24	27
So. Calif. Edison, 8% com.	43½	31½	45
Southern Cities Utilities, 7% pf.	*k* 70	67	90½
Southern Cities Utilities, com. $4	*k* 30	23½	42½
Southwestern Lt. & Pwr., A $3.	63	60	65
Southwestern Lt. & Pwr., B.	63	60	65
Southwestern Lt. & Pwr., $6 pf.	88	83	91½
Southwestern Pwr. & Lt., 7% pf.	*k*112	103	110½
Springfield (Mo.) Ry. & Lt., 7% pf.	*k*102	95	102
Standard Gas & Elec., 8% pf.	65	57½	66½
Standard Gas & Elec., 7% pr. pf.	112	104½	113½
Standard G. & E., com. $3.50	59½	54	65½
Standard Power & Light, com.	29	....	....
Standard Pwr. & Lt., 7% pf.	104	98½	102½
Staten Island Edison, pf.—$6—no par.	100	99	103
Superheater, $6 com.—no par, ex. div.	162	170	185
Syracuse Lighting, 7% pf.	*k*110	103	107
Syracuse Lighting, 8% pf.	*k*117½	....	....
TAMPA ELEC., com. $2	63	....	....
Tenn. Elec. Pwr., 6% pf.	101½	92	103
Tenn. Elec. Pwr., 7% pf.	109	103	110
Terre Haute, Ind. & East. Trac., 5% pf.	*k* 26	20	30
Terre Haute, Ind. & East. Trac., com.	*k* 1	1	3
Tex. Pwr. & Lt., 7% pf.	113	104	112
Tide Water Pwr., 8% pf.	110½	105	111
Timken Roller Bear., com.—$4 no par.	134½	78	142½
Toledo Edison, 7% pf.	109	102	107
Toledo Edison, 6% pf.	*k*100	95	97
Toledo Edison, 6% com.	*k*100	....	....
Tri-City Ry. & Lt., 6% pf.	*k* 96½	96	99
UNITED GAS & ELEC., 7% pf.	102	98	102
United Gas & Elec. (N. J.), 5% pf.	74	70	77
United Gas Impr., 8% com.—50	*c*114½	89½	118½
United Lt. & Pwr., pf.—$4—no par.	*a* 53	50	57
United Lt. & Pwr., pf.—$6.50—no par	*a* 95	87	97½
United L. & P., com. A .48—no par.	13½	12½	15½
United L. & P., com. B .48—no par.	*k* 19	14	20
Utah Pwr. & Lt., 7% pf.	109	104	108½
Utica Gas & Elec., 7% pf.	106	....	....
Utica Gas & Elec., 8% com.	*k*200	....	....
Utilities Pwr. & Lt., 7% pf.	97½	93	100
Utilities Pwr. & Lt., com. A $2.	29½	27	34
Utilities Pwr. & Lt., com. B $1—no par.	20½	13½	23½
VERMONT HYDRO-ELEC., 7% pf.	*a* 97	95	100
Virginia Elec. & Pwr., 7% pf.	*k*108	105	110
WAGNER ELEC., 7% pf.	*b* 93½	68	93½
Wagner Elec., com.—no par.	*b* 35½	18½	39½
Washington Ry. & Elec., 5% com.	455	180	460
Washington Ry. & Elec., 5% pf.	100½	....	....
Washington Wtr. Pwr., 8% com.	*k*167	136	182
West Penn Elec., 6% pf.	101½	101	101½
West Penn Elec., Cl. A $7.	108	97½	110
West Penn Pwr., 7% pf.	116½	111	118
West Penn Pwr., 6% pf.	*k*109½	100½	109½
West Virginia Lt., Ht. & Pwr., 7% pf.	*k* 95	94	100
Western Pwr., 7% pf.	*k*101	98	101½
Western States Gas & Elec., 7% pf.	104	96	106
Western States Gas & Elec., com.	38	....	....
Westinghouse Elec. & Mfg., 8% com.—50	90½	67½	94½
Weston Elec. Instrument, Cl. A $2—no par.	*k* 31	30	34½
Weston Elec. Instrument, com.—no par.	*k* 12½	11	18½
Wheeling Elec., 6% pf.	*k*103	95	104
Worthington Pump, 7% pf. A.	*k* 48	44	61½
Worthington Pump, 6% B.	44	37	54½
Worthington Pump, com.	30½	20½	46
YALE & TOWNE com. $5—25	74	70½	84½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Dec. 24. *l*Bid price Wednesday, Dec. 28. *m*Latest quotations available. †Dividend rate variable.

BRAZILIAN TRACTION TO CHANGE SET-UP.—Stockholders of the Brazilian Traction, Light & Power Company, Ltd., will vote Jan. 5 on increasing the authorized ordinary stock from $110,000,000 to $190,000,000, par $100. Of the new stock, approximately 220,000 shares will be offered to the holders of ordinary shares at $100 per share on the basis of one new share for each five shares held. The unissued balance will be available for capital requirements in the future. The stockholders also propose, after this action has been taken, to change the then authorized ordinary stock from 1,900,000 shares, par $100 each, to 7,600,000 shares of no par value, four new shares to be issued in exchange for each ordinary share held.

MASSACHUSETTS UTILITY PAYS EXTRA DIVIDEND.—Directors of the Electric Light & Power Company of Abington & Rockland have declared the regular quarterly dividend of 50 cents a share and an extra dividend of 50 cents a share, both payable Jan. 3 to holders of record Dec. 15. An extra distribution of like amount was made Jan. 3 of this year.

CONSUMERS POWER COMPANY.—The Michigan Securities Commission has validated all of the bonds of the Consumers Power Company, a subsidiary of the Commonwealth Power Corporation, as legal three-fifths investments for savings banks in the state.

In its petition to the commission, the company stated that the value of its property, as shown by its books Dec. 31, 1926, was in excess of $129,000,000 and exceeded the total mortgage debt by nearly 70 per cent and that interest charges on funded indebtedness during the year mentioned were earned 4.53 times.

CITIES SERVICE EARNINGS—The earnings of the Cities Service Company for twelve months ended Nov. 30, 1927, were the largest for any twelve months in the history of the company. Net earnings of $31,821,367 for this period exceeded by 35 per cent net earnings of $23,514,087 for the twelve months ended Nov. 30, 1926. Net earnings for the month of November, 1927, were also larger than any November earnings in the company's history, amounting to $2,760,958. Net to common stock and reserves was $1,982,461, an increase of 37 per cent over last November and of 136 per cent over November, 1925.

TEXAS PUBLIC UTILITIES. — An amendment to the charter of the Texas Public Utilities Corporation of Dallas has been filed in the Secretary of State's office at Austin, increasing its capital stock from $100,000 to $1,000,000.

Business News and Market Conditions

Standard Machine Speeds Discussed

Sponsor Recommended and Special Committee Names List of Organizations to Make up Sectional Committee

AT THE request of the National Electrical Manufacturers Association, the American Engineering Standards Committee called a general conference this month to take up the standardization of speeds of driven machinery under its procedure. A preliminary conference was held some months prior to outline the problems to be laid before the general conference.

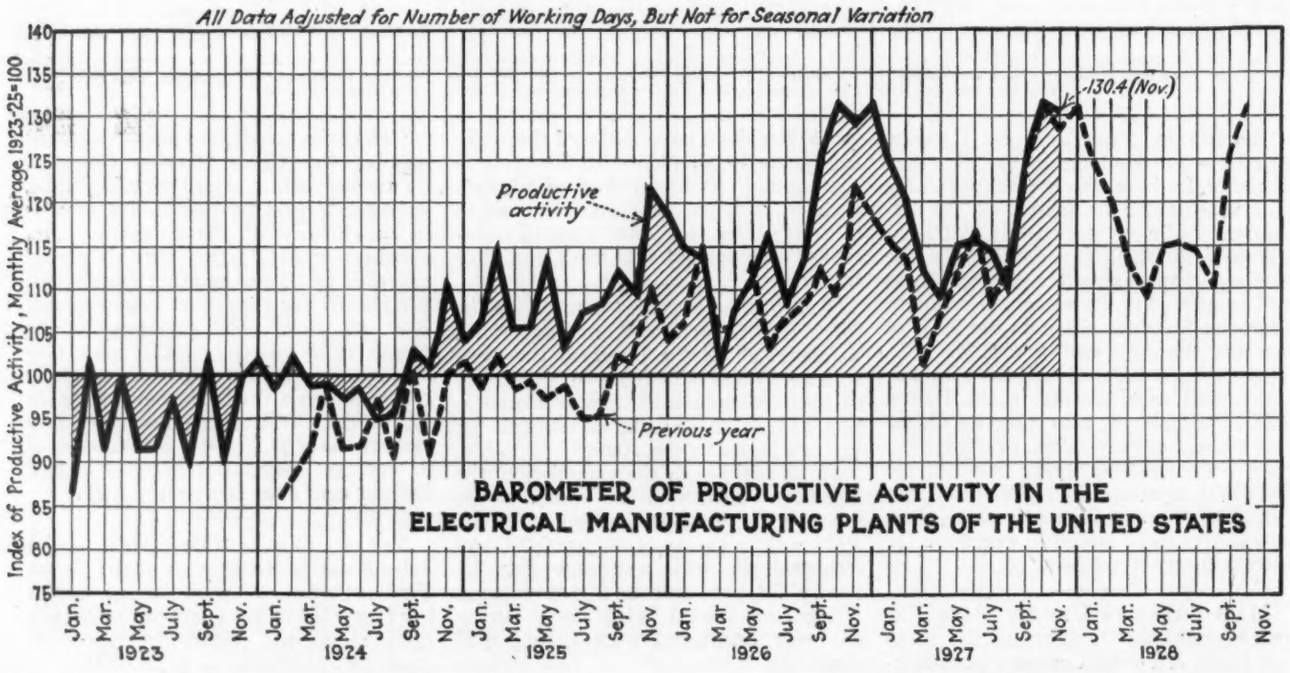
In preparing for the conference, the A.E.S.C. learned that although there was hardly any question of standardization of machine speeds in the textile industry, the speeds of 1,200 and 1,800 r.p.m. were evidently acceptable to the several groups in question. The standards committee of the National Machine Tool Builders' Association also had brought out a report recommending a series of machine speeds based on an inquiry held among the membership of the association. The report also recommended 1,200 and 1,800 r.p.m. as standard speeds for constant speed motors for machine tool drives. It furthermore recommended a series of standard sizes for machine pulleys. A firm manufacturing gear speed-reducers also proposed that standard ratios between speeds of driving and driven machines or transmission elements be established to make for standardization of speed reducing devices. At the general conference it was decided that the definition of speeds for driven machines, suggested by the preliminary conference, be referred to the sectional committee. The following resolutions were also passed: (1) That the conference recommend to the sectional committee that it keep the standard series to be developed by it, as closely as possible to the system of preferred numbers recommended by the American Engineering Standards Committee; (2) That the question to what kind of driven machines the system to be developed should apply, be left to the sectional committee; (3) That it be recommended to the sectional committee that a sub-committee be appointed to take care of the co-ordination between the activities of the American Engineering Standards Committee and the Division of Simplified Practice; (4) That it be recommended to the A.E.S.C. that the scope of the work of the sectional committee be defined as dealing with such elements of mechanical power transmission as are functions of speeds of driving and driven machinery; (5) That the conference recommend that the American Society of Mechanical Engineers be invited to be sponsor for the project, and (6) That a special committee of five members be appointed by the chairman.

The chairman appointed L. F. Adams, chairman, National Electrical Manufacturers Association; C. H. Berry, American Society of Mechanical Engineers; A. L. Stewart, National Machine Tool Builders' Association; E. H. Marble, American Society of Mechanical Engineers, and Walter Jones, Refrigerating Machinery Association. This committee met immediately after the adjournment of the conference and recommended the names of the organizations to be invited to be represented on the sectional committee. The committee reported that the work might be started with one representative from each group, with the privilege of naming an alternate, and additional representation would later be accorded if needed.

Activity About on a Level with Last Year

Production in Electrical Manufacturing Plants Holding up Well —Eleven Months' Production 2.7 per Cent Over Same Period in 1926

DURING November the electrical manufacturing plants of the nation reported that productive operations were slightly below those of October, but were slightly above those of November last year. Although the operations of the electrical manufacturing industry during the past few months have not been materially above those of the same period last year, yet the volume of production for the first eleven months of the current year appears to have shown an increase of 2.7 per cent over the same period in 1926. Evidently 1927 will show the smallest percentage of annual growth in production of any year since 1923. The smaller electrical manufacturing plants seem to be maintaining a higher



level of operations than the larger plants, but both groups have been operating close to last year for several months.

The index of activity in the electrical manufacturing industry based on consumption of electrical energy stands at 130.4 for November, as compared with 131.3 for October and 129.2 for November, 1926. Comparative indexes of productive activity referred to the average activity for the period 1923-25 as 100 and adjusted for number of working days are as follows:

November, 1927	130.4
October, 1927	131.3
September, 1927	125.4
November, 1926	129.2
November, 1925	122.0
Average first eleven months of 1927	119.0
Average first eleven months of 1926	115.7
Average for full year 1926	116.6

The November productive activities of the electrical manufacturing plants as compared with November, 1926, were on a slightly lower plane than was reported by industry as a whole. National industrial operations during November were 2.9 per cent over November, 1926, and 2.2 per cent over November, 1925. General production in November was about 6 per cent under that of May, the peak month of activity during 1927.

Heater Cords Investigated by the Industry

Results of an extensive investigation on heater cords have just been issued by the National Electrical Manufacturers' Association and the National Electric Light Association. This work was done under the direction of a joint committee of both groups of which Frank Thornton, Jr., of the Westinghouse Electric & Manufacturing Company, was chairman. In commenting on the report Mr. Thornton pointed out that the results of the work, which have a practical value to the industry, are: (1) The industry has learned more about making heating cords than it ever knew before. (2) Tangible improvements and durability have aroused the customer's interest in this type of product. (3) Quality has been definitely improved, and sub-standard products meet with much less favor than formerly. (4) The annoyance and cost of replacement has been taken from the shoulders of the distributor and eliminated to a large extent as far as the manufacturer is concerned.

Standards for Wiring Issued by Electragists

THE Association of Electragists, International, has issued a preliminary draft of a part of the "Electragist Standards for Wiring Installations." It is stated that the purpose of these standards is to define best practice in wiring. It is not intended that the standards shall in any way take the place of the National Electrical Code in America or the Canadian Electrical Code in that

Value and Destination of Electrical Exports for October, 1927, Compared with Corresponding Month in 1926

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	October 1926	October 1927
Generators:		
Direct-current:		
Under 500 kw.	$69,116	$53,917
500 kw. and over	5,015	5,700
Alternating-current:		
Under 2,000 kva.	17,004	7,740
2,000 kva. and over	.....	.....
Steam turbo-generator sets	81,406	109,617
Accessories and parts for generators	80,102	61,865
Self-contained lighting outfits	153,414	124,800
Batteries:		
Flashlight batteries	170,823	206,763
Other primary batteries	170,645	193,812
Storage batteries	298,062	313,903
Transforming or converting apparatus:		
Power transformers	209,301	62,702
Other transformers	93,218	105,375
Rectifiers, double-current and motor-generators, dynamotors, synchronous and other converters	111,112	155,223
Transmission and distribution apparatus:		
Switchboard panels, except telephone	85,071	114,203
Switches and circuit breakers over 10 amp	240,248	151,962
Fuses and fuse block	26,464	29,530
Watt-hour and other measuring meters	34,721	29,497
Volt, watt and ampere meters and other recording, indicating and testing apparatus	172,403	190,790
Lightning arresters, choke coils, reactors and other protective devices	76,384	38,601
Motors, starters and controllers:		
Motors under 1 hp	151,417	210,884
Stationary motors:		
1 to 200 hp	184,393	242,049
Over 200 hp	119,493	27,509
Railway motors	155,714	62,155
Electric locomotives:		
Railway	244,341	184,032
Mining and industrial	23,650	24,412
Starting and controlling equipment for:		
Industrial motors	136,741	127,146
Electric railway and vehicle motors	3,541	10,526
Portable electric tools	40,805	72,396
Accessories and parts for motors	137,158	235,574
Electric appliances:		
Electric fans	83,307	46,956
Electric lamps:		
Metal filament	126,426	133,722
Other electric lamps	30,119	46,920
Flashlights	138,083	203,479
Searchlights and projectors	19,729	37,596
Motor-driven household devices	142,350	174,221
Domestic heating and cooking devices	141,561	138,037
Industrial electric furnaces and ovens	9,363	27,293
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	116,444	131,781
Signal and communication devices:		
Radio apparatus:		
Transmitting sets and parts	12,375	41,236
Receiving sets	378,683	325,669
Tubes	78,992	77,396
Receiving-set components	243,206	260,144
Receiving-set accessories	395,186	324,890
Telegraph apparatus	64,783	46,803
Telephone apparatus:		
Telephone instruments	24,474	36,715
Telephone switchboards	130,809	13,296
Other telephone equipment	151,304	174,553
Railway signals, switches and attachments	30,775	78,378
Bells, buzzers, annunciators and alarms	21,426	53,929
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	121,755	192,178
Insulating material	108,281	126,937
Metal conduit, outlet and switch boxes	127,773	92,518
Sockets, receptacles and lighting switches	127,967	140,811
Electric lighting fixtures, interior and street	153,116	172,192
Other wiring supplies and line material	93,516	101,626
Other electrical apparatus, not elsewhere stated	615,999	501,315
Rubber and friction tape	29,084	26,644
Globes and shades for lighting fixtures	60,170	43,184
Electrical glassware, except for lighting	22,496	15,504
Electrical porcelain:		
For less than 6,600 volts	33,232	35,316
For 6,600 volts and over	35,062	75,783
Carbons, carbon brushes and electrodes:		
Electrodes for electric furnaces	148,428	141,309
Other carbon products	161,897	89,785
Insulated wire and cable (iron and steel)	7,819	14,394
Copper, bare wire	166,960	73,202
Copper, insulated wire and cable	391,056	275,958
Refrigeration sets up to 1 ton capacity	*	210,871
Domestic washing machines	73,420	109,750
Total	$8,109,188	$7,964,974

*Not collected in 1926.

DESTINATION OF ELECTRICAL EXPORTS

Country of Destination	October, 1927
EUROPE:	$1,348,707
Belgium	64,086
France	131,527
Germany	90,462
Italy	79,038
Netherlands	49,191
Spain	153,057
United Kingdom	510,586
Other countries	270,760
WESTERN HEMISPHERE:	$4,649,894
Canada	2,262,555
Mexico	349,571
Cuba	289,030
Argentina	453,602
Brazil	554,436
Chile	123,058
Colombia	99,439
Peru	35,699
Venezuela	82,913
Other countries	399,591
ASIA, AFRICA AND OCEANIA:	$1,966,373
British India	113,467
China	97,004
Japan	271,609
Phillipine Islands	130,313
Australia	670,793
New Zealand	182,049
British South Africa	205,574
Other countries	295,564

country, but rather that they shall supplement these codes by setting forth the many requirements of a quality installation which are beyond the scope of any safety code.

The present preliminary release includes sections covering purpose, definitions, types of wiring approved under given conditions and a part of the general requirements. Sections covering engineering design and specifications for materials and apparatus and their installation are in preparation. The preliminary draft is the work of a main committee of six of the leading contractors of America and Canada, assisted by the technical staff of the A.E.I. According to the precedure adopted, this and all other material prepared by the main committee will be submitted to a large technical advisory committee so elected as to be geographically representative of the entire territory of the two countries. Final action will be taken by the main committee, after due consideration of reports received from the advisory committee. While this is purely an Electragist undertaking, the committee in charge of this work states that it is the desire to secure the cooperation of all the other national bodies of the electrical industry wherever the interests of these organizations are affected. The members of the main committee are: A. Penn Denton, chairman, Denton Engineering & Construction Company, Kansas City, Mo.; G. E. Shepherd, Shepherd-Rust Electric Company, Wilkes-Barre, Pa.; J. H. Schumacher, Schumacher-Mackenzie-Kummen, Ltd., Winnipeg, Manitoba, Canada; Allen Coggeshall, Hatzel & Buehler, Inc., New York; A. C. Brueckmann, Brueckmann Electric Company, Baltimore, Md.; and W. Creighton Peet, Peet & Powers, Inc., New York.

Market Conditions

INDUSTRIAL-PLANT buying during December has shown marked improvement over the inactive period of the previous two months. A steel mill placed an order in the Eastern district for a 2,000-kw. motor-generator set, and a fair volume of inquiries for other machinery of this character is reported. Orders placed in New England call for about $500,000 worth of material for railroad electrification, and interest in industrial electric heating is rapidly gaining. Steam railroads are entering the market and are especially interested in improved car lighting and station illumination.

A power transformer order from an Alabama power company amounted to $175,000. Two 4,000-kw. turbines were also purchased by a steel mill in that state, and a rayon mill in Tennessee ordered a 3,000-kw. turbine, transformers, etc., amounting to $150,000. In the Middle West greater expansion and activity of utilities during the coming year is anticipated. A large order covering 100 pumps and motors from 250 hp. down for mills now being constructed at Hoquiam and Port Townsend, Wash., was placed on the Pacific Coast. The construction of a three-million-dollar pulp and paper mill in Seattle and a six-million-dollar paper mill in the Gray's Harbor district will begin shortly after the first of the year.

Non Ferrous Metal Market Quiet—Prices Steady

Prices on the non-ferrous metal market have been steady with sales quiet. No sellers have taken the opportunity to depress the market for any reason. A good spring business is expected in metal-consuming lines. The large producing interests have continued to quote 14⅛ cents for domestic deliveries of copper in the East all week, but have taken only an occasional order, chiefly where a particular brand of copper was desired. A fair amount of business was done in the Middle West last week Friday at 14¼ cents, however. The custom smelters have in general quoted 14 cents, delivered Connecticut, since last week Thursday, when the last of the 13⅞-cent copper was absorbed. They seem to be making a firmer stand and are well content to do only a moderate amount of business until after the holidays are over; then another good buying movement is expected, as considerable February copper apparently remains to be bought.

NEW YORK METAL MARKET PRICES

	Dec. 21, 1927 Cents per Pound	Dec. 28, 1927 Cents per Pound
Copper, electrolytic	13.875	14
Lead, Am. S. & R. price	6¼	6¼
Antimony	11¼	10¼
Nickel, ingot	35	35
Zinc spots	6.00	6
Tin, Straits	58¼	57⅛
Aluminum, 99 per cent	25	24.30

Base copper price Dec. 28, 1927, 16 cents.

Though somewhat below average in respect to volume of sales, the lead market was not dead during the week ended Wednesday, and a modest tonnage of January metal changed hands. The leading interest in the Middle West quoted 6.325 cents all week, but business done at this figure was all but negligible, such sales as were made by this company being on an "average" price basis. Other sellers did some business at 6.30 cents, and any reasonable amount of metal could have been obtained at that level on any day during the week. In the East the American Smelting & Refining Company maintained its official contract price at 6½ cents. A feature of the last few days has been the excellent demand from abroad.

Industrial Demand Encouraging in Eastern District

The call from industrial interests is forming a feature of year-end business in the Eastern district. The leading demand is from the metal-working industries, paper mills and specialty factories. Inquiries from textile mills indicate that commitments can be looked for from that quarter in the early weeks ahead. A prominent manufacturer has closed an order for a 2,000-kw. motor-generator set for an iron and steel mill and reports a fair volume of inquiries for other machinery of this character. November, it is stated, was one of the slowest months in actual sales, with December business showing an appreciable higher average. The outlook for orders after the turn of the year is considered good. One of the leading producers of controller equipment says that there has been a decided change in the market within the past week or so, and forthcoming business appears encouraging. Inquiries for apparatus are maturing steadily and sizable sales are anticipated in the very near future. This company states that actual orders for the past 60 days have been at low ebb and that gross business for the year will show a decrease as compared with 1926 sales. An electrical supply jobber says that electrical appliances have moved better this Christmas season than at any previous holiday period. Central-station business in the New York district is expected to advance substantially within the next 30 to 60 days. Inquiries for substation apparatus are showing signs of revival and utility companies are coming into the market for wire and cable requirements.

The Philadelphia district shows little change excepting in the line of inquiries for motors and other industrial electric equipment, which are expected to be followed by early commitments. Heavy electrical machinery sales are quiet, but transmission-line apparatus is drawing better attention than in several weeks. Wiring supplies are moving actively. The holiday trade brought a good demand for electric refrigerators as well as smaller domestic specialties. In a comment regarding the outlook for electric and other utilities in the Philadelphia territory Philip H. Gadsden, vice-president United Gas Improvement Company, states that in so far as the light and power business constitutes a barometer of trade, the coming year looks particularly promising, indicating the most satisfactory commercial year in the history of the business.

Construction projects in the Eastern District include the following: The New York Edison Company has taken out a permit for the construction of a three-story power substation at 419 East Forty-sixth Street to cost $450,000. The American Gas & Electric Company has engaged Stevens & Wood, Inc., engi-

neer, to prepare plans for a steam-operated power plant on the Delaware River, opposite Wilmington, Del., with an initial capacity of 100,000 kw. and an ultimate output of 400,000 kw., including construction of transmission lines for power supply to the Delaware Electric Power Company and the Atlantic City Electric Company, affiliated organizations. The Public Service Electric & Gas Company plans the construction of a two-story substation at Ridgewood, N. J., and will also build a two-story addition to its commercial building at Hackensack, N. J. The Camden Rail & Harbor Terminal Corporation, Camden, N. J., will soon take bids for a proposed nine-story cold storage and refrigerating plant to cost approximately $2,000,000, with machinery. The Pennsylvania Edison Company has acquired the Saylorsburg Light & Power Company and plans transmission-line extensions in the Cherry Valley district. The Monongahela-West Penn Public Service Company, Pittsburgh, is negotiating for the purchase of the Webster Springs (W. Va.) Electric Light Company and plans expansion in that territory. The Bureau of Supplies and Accounts, Washington, D. C., is asking bids until Jan. 10 for turbo-generator sets for the Brooklyn, Mare Island and Puget Sound navy yards.

Large Power Transformer Order Placed in Southeast

Activity in the electrical field in the Southeast has been satisfactory. The largest order placed was for power transformers amounting to $175,000 and was received from the Alabama territory. Alabama was also responsible for an order for two 4,000-kw. turbines to be installed in a steel mill. A rayon plant in Tennessee ordered a 3,000-kw. turbine with transformers and motor-generator sets totaling about $150,000. A textile plant in Georgia ordered motor-control equipment totaling $11,000, and a public address system costing $15,000 was recently ordered for installation at a race track at New Orleans. With the exception of the power-transformer order mentioned above, no large orders are being received from the central-station companies, such orders as are coming in being mainly for current needs. Transformers in sizes up to 250 kva. are in satisfactory demand.

The expansion activities of the larger power companies are reflected in the orders for line-construction materials. One company ordered copper wire amounting to $8,300, distribution and small power transformers totaling $7,200 and $5,100 worth of creosoted pine poles. A small power plant in south Georgia has placed an order for a 150-kw. generator. A central-station company in Georgia has obtained a contract covering an electric sign to cost about $2,500 for a commercial establishment. One industrial truck for the Birmingham territory was ordered, and five of these trucks were recently purchased in the New Orleans section. Jobbers report the holiday trade as having been good.

Construction projects are as follows: The Baker County Power Company plans extensions at Edison and Arlington, Ga., and vicinity, including transmission line construction. The Kentucky-Tennessee Light & Power Company plans to extend its ice plant at Cloverport, Ky. The Inland Utilities Company is reported negotiating for purchase of the municipal electric light plant and waterworks at New Albany, Miss., and contemplates expansion in the district. The Tennessee Electric Power Company, Chattanooga, is said to be arranging an expansion program to cost about $5,000,000, including extensions in hydro-electric power plants at Hale's Bar and transmission-line construction.

New England Interested in Electric Heating Furnaces

Interest in industrial heating is rapidly gaining in the New England district. Negotiations exceed in number those of all previous years at this time. Sales are reported by one prominent manufacturer to include a variety of types. Electric arc-welding equipment sales have been heavy. One order for such equipment for use on a 20-mile pipe line was placed at a cost of about $15,000. A prominent manufacturer of small-pressure tanks will equip with welders costing over $40,000. The volume of sales will be well over that of last year and is likely to show further gain in 1928.

Industrial equipment business is slack and central-station buying is moderate. Steam railroads are entering the market and orders are gaining, with interest marked in improved car lighting and station illumination. Recent orders for new electrification received by one company exceed $500,000. Appliance sales are steady, and new business prospects are encouraging. An exceptional mercantile project, estimated at $20,000,000, including office and stores, is planned for the immediate future in Boston. The Lynn Gas & Electric Company, Lynn, Mass., plans an expansion program in 1928 to cost close to $1,500,000. An addition will be built to the steam-power station to cost more than $750,000.

No Contracts of Importance Closed in St. Louis District

The usual holiday hesitation on the part of purchasers to close contracts of importance was noted in the Southeast. An order was placed by a large industrial concern for one 50-hp. and two 100-hp. motors at a total cost of $4,000. Another order from a manufacturing company called for a bank of transformers to cost $2,750. Favorable weather conditions caused the demand for all kinds of electrical appliances to hold up in good volume.

Construction projects reported are as follows: Sterling, Kan., will extend its municipal electric light and power plant at a cost of about $30,000. Covington, La., is asking bids until Jan. 12 for the installation of an ornamental lighting system in the downtown district. Campbell, Mo., is asking bids until Jan. 10 for the construction of a municipal electric light and power plant, to cost about $45,000. Thayer, Mo., will soon begin the construction of a municipal electric light and power plant, to cost about $75,000. The Morgan Utility Corporation, Brownwood, Tex., plans the construction of an electric light and power plant. An adjoining site has been secured and work will soon begin on a one-story ice plant, 50 ft. x 175 ft., to cost about $100,000, with machinery. Canadian, Tex., is arranging for the installation of equipment for a municipal electric power plant. Colorado, Tex., plans to install a municipal electric light and power station and ice plant. The Texas-Louisiana Power Company, Fort Worth, has plans maturing for a one-story steam-operated electric power plant at Nacona, Tex., 150 ft. x 250 ft., to cost more than $250,000, with equipment. The Valley Electric & Ice Company, San Benito, Tex., has acquired property at Raymondville, and plans the construction of an ice and cold-storage plant to cost about $100,000, with machinery.

Sales in Middle West Continue at Fair Level

Business in the Middle West continues at much the same level. The holiday season closed a good year for many and a satisfactory one for most manufacturers. With increased tonnage placed with the steel mills, with large requirements of equipment being ordered by the railroads, and with general conditions good, the Middle West looks forward to a larger and more prosperous year in 1928. The various utility companies have had a prosperous year, and present indications point to greater expansion and activity during the coming year. Daily commitments of one large company are running considerably higher, with the December figure about 200 per cent higher than that of June and about 65 per cent of the January amount. Jobbers' sales are about normal for this period of the year.

Construction projects are as follows: The South Park Commissioners plan an ornamental lighting system in Chicago on the lake front, from Twenty-third to Thirty-first Street, estimated to cost $50,000. The Southern Utilities Company, Burlington, Iowa, plans a transmission line from Burlington to the drainage districts, reported to cost in excess of $15,000. The Elkhorn Valley Power Company, Scribner, Neb., plans extensions in 33,000-volt transmission lines, about 14 miles, estimated to cost $20,000 as well as a new substation. Ohio State University, Columbus, Ohio, will take bids for a power house at the institution to cost close to $450,000. John A. Shafer, Illinois Building, Indianapolis, Ind., has plans for a hydro-electric power plant near Greenfield, Ohio, to cost more than $2,000,000, for

a new company now being organized by M. Irwin Dunlap, Greenfield. The Wheeling Steel Company, Wheeling, W. Va., plans a new steel-strip mill at Steubenville, Ohio, to cost close to $5,000,000. Sealed proposals will be received at the office of the Commission of Purchases and Supplies, City Hall, Cleveland, until Jan. 6 for constant current regulating transformers for the Division of Light and Power.

Large Pulp Mill Order Placed on Pacific Coast

Machinery orders on the Pacific Coast have included three feeder regulators, valued at $5,000, for installation in the Bay District; 54 assorted transformers, valued at $7,000, for general plantation service in the Hawaiian Islands, and 40 assorted transformers, valued at $3,500, for installation around Reno, Nev. Miscellaneous orders include the complete electric lighting installation for the city of Sacramento's airport at a total cost of $10,000, $4,000 worth of miscellaneous conduit material and wire for a remodeled oil plant, quantity orders from railroads and power companies for flashlight and dry batteries, an assorted carload of double-galvanized strand for a power company, and half a carload 30 per cent rubber-covered wire, as well as a quantity of pole-line hardware. Early reports as to holiday buying indicate that this was a radio Christmas, that very few large appliances were sold, that waffle irons and toasters were excellent sellers, but that percolators and sets were in little demand.

An award of a contract for furnishing what is said to be the largest order of pumps and motors for pulp-mill installation in the Northwest, involving approximately a hundred pumps and a like number of motors, ranging from 250 hp. down, was let last week to the Allis-Chalmers Manufacturing Company for installation in the pulp mills being constructed at Hoquiam and Port Townsend, Wash. Other sales of motors made include eighteen from 50 hp. down for a small construction sawmill at Longview for the Weyerhaeuser Timber Company, the initial step in building the largest sawmill in the world; one 40-hp. and three 25-hp. motors for a Seattle box factory, three 60-hp. motors for a pulp mill at Shelton and about 30 assorted units to dealers. Construction of a three-million-dollar pulp and paper mill in Seattle and a six-million-dollar paper mill in the Gray's Harbor district, with work to start after the first of the year, are announced. Award of contract for constructing approximately $1,000,000 worth of buildings in Tacoma for the Union Bag & Paper Corporation was made last week, and specifications are being written for the electrical apparatus for the project.

Construction projects are as follows: Los Angeles will install an ornamental lighting system on New Hampshire and other streets. Madera, Cal., plans an ornamental lighting system on F Street. Oakland is asking bids until Jan. 9, for electric motors for ventilating equipment service. Riverside, Cal., will install a lighting system on Main Street. The Pacific Fruit Express Company, San Francisco, plans an ice plant, 165 ft. x 440 ft., at Fresno, Cal., to cost close to $1,000,000. The National Ice & Cold Storage Company, San Francisco, plans an ice and cold-storage plant at Hollister, Cal., to cost about $100,000. The Truckee Utility District, Truckee, Cal., has approved a bond issue of $20,000 for an electric light and power distributing system. Willows, Cal., plans an ornamental lighting system in the downtown district, estimated to cost $15,000. The Public Service Company of Colorado contemplates a hydro-electric power plant in the vicinity of Canyon City, Colo., with transmission system in the Alamosa district, reported to cost more than $2,000,000. The Kelso Paper Company, Kelso, Wash., plans a new pulp mill, reported to cost in excess of $175,000. The Western Public Service Company plans a transmission line to Laramie, Wyo., by way of Cheyenne, for local light and power service.

Activities of the Trade

Westinghouse Electric Elects New Officers

At a meeting of the board of directors of the Westinghouse Electric & Manufacturing Company held this week, the following officers were elected: Clinton M. Finney, comptroller; Warren H. Jones, secretary, and Edward J. Mulligan assistant secretary. Mr. Finney was formerly with the Worthington Pump & Machinery Corporation, where he held the office of comptroller since 1919 and of vice-president since 1926. Prior to that time he was secretary and treasurer of the Mack Truck Companies and treasurer of the George V. Crosson Company. Mr. Jones has held the position of assistant secretary of the Westinghouse company from 1911 to date. Mr. Mulligan began his business career as office boy to George Westinghouse twenty-five years ago. Since that time he has remained continuously in the executive department of the company.

General Electric Company Creates Motor Division

Announcement of the creation of a motor division of its industrial department has been made by the General Electric Company through E. O. Shreve, manager of the department involved. The new division will have general supervision of all policies, prices, etc., concerning all motors handled by the industrial department. F. M. Kimball has been appointed advisory manager, and J. E. N. Hume manager of the division in question, both appointments being effective Jan. 1, 1928. K. H. Runkle has been appointed manager of mining and steel mill sales to succeed Mr. Hume.

THE W. B. CONNER COMPANY, INC., 369 Lexington Avenue, New York City, manufacturer and distributor of "Ace" steam traps and other steam specialties, has acquired from the Stebbins Engineering & Manufacturing Company, all rights, patents and interests in the "Shortt" pumping traps. The company announces that it is now prepared to furnish the trap in a variety of capacities for pumping high-temperature fluids, for draining equipment such as condensers, and for feeding boilers.

THE SUNDH ELECTRIC COMPANY, INC., 5 Avenue C, Newark, N. J., manufacturer of electric control apparatus, announces the appointment of the following representatives: Oliver B. Lyman, Call Building, San Francisco; Joy & Cox, 314 Tramway Building, Denver; Jos. W. Eshelman, 307 South Twentieth Street, Birmingham, and the Chas. L. Ward Company, 717 Bryant Building, Kansas City and Omaha.

THE COCHRANE CORPORATION, Seventeenth Street, below Allegheny Avenue, Philadelphia, announces the appointment of the Cochrane Sales Company, Inc., 50 Church Street, New York City, as its representative for the sale of Cochrane steam-power-plant equipment, succeeding F. E. Idell, deceased. The officers of the Cochrane Sales Company are F. B. Sage, A. R. Foote and W. W. Montalvo, Jr., who for a long time have been associated with Mr. Idell in the sale of Cochrane equipment.

THE MARTINDALE ELECTRIC COMPANY, 1260 West Fourth Street, Cleveland, manufacturer and national sales agent of motor maintenance equipment, has opened a branch in New York City at 6 East Forty-sixth Street, in charge of E. H. Mitcham.

THE ADAPTI COMPANY, 2996 East Seventy-second Street, Cleveland, announces changes in its "Adapti-let" line of rigid conduit fittings. The body sizes have been reduced in number as far as possible. For example, the ½-in. and ¾-in. bodies are now made with the same general dimensions and differ only in the size of the hub. All fittings also are now made with a flat bottom, and screw holes for the covers are made in the extreme corners of the fitting to prevent damage of the insulation from the screws projecting into the fittings.

THE HYMAN-MICHAELS COMPANY of Chicago has been appointed sales agent for the Mid-west territory of the Ohio Locomotive Train Company and

its subsidiary, the Toledo Crane Company. These companies manufacture all types of cranes.

THE BURNDY ENGINEERING COMPANY, 10 East Forty-third Street, New York City, has been appointed distributor for "Everdur" metal made by the American Brass Company. This material is a new alloy consisting of copper, silicon and manganese, and is said to have unusual properties of strength and corrosion resistance. The Burndy company is preparing to stock "Everdur" not only in all basic forms, such as ingot, tube, sheet, bar, etc., but is also in a position to supply all castings and forgings of this material. A stock of bolts, nuts and rivets is maintained in New York.

THE STANDARD ELECTRIC STOVE COMPANY, Toledo, Ohio, has appointed Barkley, Bauder & Close, 10 High Street, Boston, as district representatives for the New England States with the exception of Fairfield County, Conn., which is handled from the New York office. The company also has completed arrangements with E. B. Latham & Company of New York and Jones-Beach & Company of Philadelphia for distributorships. E. B. Latham & Company will distribute in southern New York and northern New Jersey and Fairfield County, Conn. Jones-Beach & Company will distribute in eastern Pennsylvania and New Jersey.

THE RAILWAY & INDUSTRIAL ENGINEERING COMPANY, Greensburg, Pa., is extending its machine shop to provide 3,500 sq.ft. of additional floor space. This will give approximately 110,000 sq.ft. of floor space which will be devoted entirely to the manufacture of interchangeable unit, outdoor and indoor switching equipment.

CURTIS LIGHTING, INC., Chicago, announces the appointment of two new resident engineers. Howard J. Martin will manage the Milwaukee territory with offices in that city, and Thomas H. Morrison will represent the firm in Denver. Both men were previously active in the home office of the company in Chicago.

CURTIS LIGHTING, INC., Chicago, manufacturer of "X-Ray" reflectors, announces the appointment of Irving D. Smith as resident engineer for the Dominion of Canada, with offices at the Union Trust Chambers, 105 Victoria Street, Toronto.

THE WHEELER REFLECTOR COMPANY, 275 Congress Street, Boston, announces the new two-piece "Isolux" reflector for sign lighting.

MANNING, MAXWELL & MOORE, INC., New York, has organized two operating companies under the laws of Delaware. They are the Consolidated-Ashcroft-Hancock Company and the Shaw Crane-Putnam Machine Company. The Bridgeport and the Boston plants of the company and the sales force marketing the products of these plants will make up the Consolidated-Ashcroft-Hancock Company, while the Shaw Crane-Putnam Machine Company takes over the Shaw Crane Works and the Putnam Machine Works and the sales activities pertaining to them. The supplies department and the Chicago machinery branch office of the company will operate as formerly.

THE H. B. SHERMAN MANUFACTURING COMPANY, Battle Creek, Mich., announces the Sherman heavy-duty soldering lug, made to the specifications prepared by the N.E.L.A. for its standardized line of lugs for heavy duty.

THE CHAS. L. WARD COMPANY, manufacturers' agent, announces its removal to 701 Midland Building, 1229 Baltimore Avenue, Kansas City, Mo. The company represents Schweitzer & Conrad, Inc., the G & W Electric Specialty Company, the Franklin Porcelain Company, the Electric Service Supplies Company, the Cutter Electrical and Manufacturing Company, the Sundh Electric Company, Inc., and the Minerallac Electric Company.

THE REYNOLDS ELECTRIC COMPANY, 2650 West Congress Street, Chicago, manufacturer of fractional-horsepower motors and motor-driven appliances, announces the opening of a display room and warehouse in New York City at 256 West Thirty-first Street. George H. Erich and Leo A. Leissler will represent the company at that office.

New Equipment Available

Short-Circuiting and Grounding Switch

A three-position switch for connecting the primary cable to the high-voltage windings of the transformer, disconnecting the cable from such windings and short-circuiting and grounding the windings, with an electric interlock on the switch to prevent its operation while either transformer or transformer and cable are energized, has been developed by the Packard Electric Company, Warren, Ohio. In normal operation the switch connects the primary windings of the transformer to the supply lines. In another position it opens this circuit, and the supply lines, which might be lead-covered cable, being disconnected from the transformer windings, may be tested out for faults or may be put into service to carry other transformers. In the third position the switch simultaneously short-circuits and grounds the primary windings of the transformer and disconnects the supply lines. Under this condition the automatic network breakers in the secondary circuit are open, the protective fuses in series with these breakers may be removed, and the transformer, switch or automatic breaker may be worked upon with safety.

Since the electric interlock is actuated from the secondary leads of the transformer, the switch can be operated only when there is no voltage across these leads. Thus before changing the switch from one position to another the primary supply line must be de-energized and the secondary breakers opened.

Centrifugal Pumping Unit

The type SSU centrifugal pumping units placed on the market by the Allis-Chalmers Manufacturing Company, Milwaukee, are combined motor and pump units not much larger than a motor alone. The manufacturer states that the pump and motor ends are properly proportioned to work together as an efficient, reliable unit. The unit is closely coupled by fastening the pump impeller to one end of the extended motor shaft, and the pump casing is bolted to a special integrally cast extension of one of the motor end housings. This eliminates a base plate, coupling and pump bearings and does away with the possibility of misalignment between the pump and motor. The motor bearings, which are the pump bearings as well, are over-size Timken tapered roller bearings, having ample thrust and radial capacity, and are mounted in dust-tight and grease-tight housings. The pumps are built in 1¼-in. x 1¼-in., 1½-in. x 1½-in., 2-in. x 2-in. and 2½-in. x 2½-in. sizes and can be used with 1, 1½, 2, 3, 5 and 7½-hp. motors. The capacities handled range from 25 to 200 gal. per min. against heads of from 50 ft. to 100 ft.

Protector for Street-Lighting Transformer

The "Novalux" protector, announced by the General Electric Company, is designed to disconnect the street-lighting transformer from the primary source of supply in case of open circuit. This protector, bearing the designation N-1, is virtually a "safety-first" mechanism. It is designed to operate in conjunction with a "Novalux" controller, and its function is to open the switch in the controller as soon as the open circuit takes place. The mechanism of the protector consists of two solenoids working in opposition with a common armature. One solenoid is energized by the controlling circuit, the other by the load circuit to be protected. Under normal conditions both coils are energized and the common armature remains in its lower position. However, when an open circuit occurs in the load circuit the lower solenoid is de-energized and the armature rises instantly because of the overbalancing force of the upper solenoid. This movement of the armature closes a contact which de-energizes the controller.

Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 13, 1927)

1,652,191. ELECTRICAL APPLIANCE; F. P. Withers, South Milwaukee, Wis. App. filed Sept. 26, 1925. Means for electrically connecting a conductor with a ground rod of the copper-clad type.

1,652,194. AUTOMATIC CUT-OVER AND SAFETY SWITCH; L. A. Brown, Uniontown, Pa. App. filed March 16, 1927. Designed for use on mine locomotives and similar machines which have a trailing cable and trolley for connecting with the source of supply.

1,652,200. ELECTRIC RESISTANCE FURNACE; A. J. Hanson, Arlington, Mass. App. filed Jan. 23, 1924. In which the resistor is muffled or confined in the furnace wall.

1,652,202. PIVOTAL MOUNTING FOR USE IN INSTRUMENTS OF PRECISION; F. C. Holtz, Springfield, Ill. App. filed May 3, 1923.

1,652,220. CONTROLLING MEANS FOR ELECTRICAL APPARATUS; P. A. Topper, Philadelphia, Pa. App. filed March 16, 1925. For maintaining a motor at the same speed regardless of varying load conditions; for use with a direct-current shunt motor or a slip-ring motor.

1,652,230. THERMAL TIME-LAG RELAY; E. Besag, Baden-Baden, Germany. App. filed Oct. 15, 1925.

1,652,261. ELECTRIC DISTRIBUTING SYSTEM; P. Torchio, Bronxville, N. Y. App. filed Oct. 16, 1924.

1,652,319. ELECTRIC MOTOR AND TRANSMITTER UNIT; J. M. Naul, Plainfield, N. J. App. filed May 9, 1925. Used as individual driving units for sewing or other small machines.

1,652,321. ELECTRIC SWITCH; G. W. O'Keefe, Dorchester, Mass. App. filed Dec. 21, 1922. Adapted to control small motors.

1,652,346. MULTIPHASE THERMALLY ACTUATED CIRCUIT CONTROLLER; G. A. Burnham, Saugus, Mass. App. filed May 21, 1924.

1,652,364. DOOR-CONTROLLED ELECTRIC LIGHTING SWITCH; J. M. Kern, Oswego, N. Y. App. filed June 6, 1922.

1,652,391. ELECTRIC CONTROLLER; H. E. Campbell, Milwaukee, Wis. App. filed Nov. 27, 1922. For use in mines or where combustible gaseous zones are encountered.

1,652,398. LAMP SOCKET; E. A. Everett, New York, N. Y. App. filed Oct. 26, 1925. For obtaining an accurately positioned source of illumination.

1,652,400. BRAKE; J. W. Dodd, Brookline, Mass. App. filed Oct. 29, 1924. Electromagnet brakes for elevators, hoisting apparatus and the like.

1,652,401. ELECTRIC DRILL; F. P. Forss, Aurora, Ill. App. filed Jan. 5, 1925. Air-cooled electric motors for portable electric drills.

1,652,405. SYSTEM AND APPARATUS FOR MEASURING ELECTRICAL RESISTANCE; J. A. Holliday, New York, N. Y. App. filed March 22, 1922.

1,652,409. MEANS FOR FUSING MATERIAL AND DELIVERING THE SAME; L. H. Moulthrop, South Norwalk, Conn. App. filed April 17, 1926. Adapted for use as a "spot-waxing" device to apply a quantity of wax to seal a connection in electrical devices.

1,652,425. TROLLEY GUARD; H. P. Chandler, Mansfield, Ohio. App. filed Oct. 14, 1925. For use in mines.

1,652,481. ELECTRIC TUBE WELDING MACHINE; G. V. Johnston, Chicago, Ill. App. filed Nov. 19, 1923. For butt-welding tubing.

1,652,482. SHORT-CIRCUITING DEVICE FOR ELECTRIC MOTORS; C. L. Kennedy, Braintree, Mass. App. filed May 25, 1927.

1,652,484. SWITCH MECHANISM; F. B. Kniskern and J. R. Shuster, Wilkinsburg, Pa. App. filed March 24, 1921. Inclosed switch mechanism of the safety type.

1,652,492. ELECTRIC MOTOR AND TRANSMITTER UNIT; J. M. Naul, Plainfield, N. J. App. filed May 9, 1925. For the individual operation of sewing or other small machines.

1,652,495. GRAPHIC POWER-FACTOR METER; R. T. Pierce, East Pittsburgh, Pa. App. filed Aug. 22, 1922.

1,652,503. RESISTOR SUPPORTING UNIT; E. E. Sutherland, Mansfield, Ohio. App. filed Aug. 9, 1924.

1,652,504. SYSTEM OF CONTROL; W. E. Thau, Pittsburgh, Pa. App. filed Jan. 30, 1923. For electrically driven vessels, such as ferryboats.

1,652,506. LINK-TYPE INSULATOR; N. A. Wahlberg, Wilkinsburg, Pa. App. filed Oct. 11, 1923.

1,652,508. OIL SWITCH AND CONTROLLING MECHANISM; C. Aalborg, Pittsburgh, Pa. App. filed Sept. 2, 1922.

1,652,512. OVERLOAD RELAY; B. O. Austin, Wilkinsburg, Pa. App. filed Jan. 30, 1923. Automatic switching mechanism for an electric vehicle.

1,652,523. SUPERPOWER SYSTEM; C. LeG. Fortescue, Pittsburgh, Pa. App. filed Dec. 11, 1922. For regulating the interchange of power between two constant-potential alternating-current lines; has particular application to superpower systems which are tied to smaller independent electrical systems in such manner that short circuits on the smaller systems shall not damage the superpower line.

1,652,526. ARC-WELDING GENERATOR; S. Hancock, Wilkinsburg, Pa. App. filed May 24, 1923.

1,652,527. PROTECTIVE DEVICE; C. H. Hodkins, Pittsburgh, Pa. App. filed Nov. 8, 1924. Thermal relay with a snap action.

1,652,531. SWITCH BOX; O. S. Jennings, Brooklyn, N. Y. App. filed Nov. 20, 1919. Safety switch box.

1,652,538. TESTING APPARATUS; R. E. Marbury, Wilkinsburg, Pa. App. filed Aug. 28, 1925. For testing the insulation of condensers, electrical windings, cables, etc.

1,652,541. ELECTRIC SNAP SWITCH; C. Neil, Hartford, Conn. App. filed Aug. 14, 1924.

1,652,550. CONTROL APPARATUS; A. A. Yeager, Jr., Saginaw, Mich. App. filed Feb. 12, 1925. Time-element relay.

1,652,557. TRANSFORMER CONNECTION FOR HOT CATHODE RECTIFIERS; E. W. Breisch, Edgewood, Pa. App. filed Nov. 20, 1920.

1,652,559. PROTECTIVE RELAY SYSTEM; W. H. Cole, Abington, Mass. App. filed Jan. 23, 1925. For the protection of the busbars and feeders of a distribution network.

1,652,569. SWITCH MECHANISM; W. M. Grant, San Francisco, Calif. App. filed March 24, 1921. Box for containing switch and fuse mechanism.

1,652,686. COMBINATION RADIANT AND CONVECTION HEATER; J. Schoenfeld, Alameda, Calif. App. filed April 13, 1925.

1,652,689. DISCONNECT AIR-BREAK LINE SWITCH; J. E. Sumpter, Minneapolis, Minn. App. filed Aug. 20, 1923.

1,652,693. CUT-OUT INSULATOR; T. Bailey, Christchurch, Canterbury, N. Z. App. filed June 19, 1925.

1,652,745. ELECTRIC TOASTING AND HEATING APPLIANCE; H. J. Tannenbaum and D. Brown, New York, N. Y. App. filed Feb. 2, 1927.

1,652,773. CONTACTING DEVICE; E. S. Ensign, Brookline, Mass. App. filed Oct. 20, 1925. For use in refrigeration chambers.

1,652,782. REPEATING FUSE SWITCH; L. B. Green, Lakewood, Ohio. App. filed Jan. 20, 1925.

1,652,795. INCLOSED SWITCH; C. D. Platt, Bridgeport, Conn. App. filed Aug. 12, 1922.

1,652,804. CLAMPING ELECTRODE; F. H. Wappler, Flushing, N. Y. App. filed April 6, 1925.

1,652,809. MOUNTING AND RETAINING MEANS FOR ELECTRICAL UNITS; C. W. Bassett, Montclair, N. J. App. filed March 20, 1926. Such as flashlight bulbs with retaining means for installing in group formation in a suitable panel, such as a signal board.

1,652,831. MOTOR CONTROL; N. L. Mortensen, Milwaukee, Wis. App. filed June 8, 1921. For motors subjected to variable positive loads and negative loads which may be of corresponding magnitude, such, for example, as crane motors and the like.

1,652,882. AUTOMATIC CONTROL EQUIPMENT; M. A. Whiting, Schenectady, N. Y. App. filed Nov. 17, 1922. For synchronous converters.

1,652,893. HIGH-POTENTIAL CABLE JOINT AND METHOD OF INSTALLATION; E. B. Eby, Pittsburgh, Pa. App. filed Feb. 21, 1927.

1,652,899. MERCURY-ARC RECTIFIER; C. Kramer, Pankow, Berlin, Germany. App. filed May 17, 1927.

1,652,904. AUTOMATIC CONTROL EQUIPMENT; G. R. McDonald, Schenectady, N. Y. App. filed Nov. 29, 1922. For synchronous converters.

1,652,911. TRANSFORMER; I. H. Sclater, Pittsfield, Mass. App. filed Nov. 18, 1926. Of the shell type in which the core comprises a central leg surrounded by the windings and a plurality of outside legs joined by suitable core yokes to the central leg to provide return paths for the magnetic flux induced in the central or winding leg.

1,652,913. LIGHTNING ARRESTER; F. J. Skonier, Altoona, Pa. App. filed Oct. 30, 1926.

1,652,921. MERCURY-VAPOR RECTIFIER; L. Wimberger, Vienna, Austria. App. filed June 30, 1926.

1,652,923. VOLTAGE REGULATOR; E. F. Alexanderson, Schenectady, N. Y. App. filed March 17, 1926. Comprising a variable impedance device connected to the circuit and arranged to have its impedance regulated by thermionic means operable in accordance with variations in the circuit conditions.

1,652,938. INDUCTANCE COIL; E. M. Hewlett, Schenectady, N. Y. App. filed Sept. 18, 1923. For use in radio signaling systems for high power.

1,652,945. STORAGE-BATTERY FLUID; J. K. Klain, Wynnefield, Pa. App. filed Aug. 5, 1925.

1,652,969. AUTOMATIC SUBSTATION CONTROL EQUIPMENT; M. A. Whiting, Schenectady, N. Y. App. filed Sept. 15, 1922. For synchronous dynamo-electric machines.

1,652,974. PROTECTIVE SYSTEM; W. Bruckel, Berlin, Germany. App. filed April 22, 1925.

1,652,981. ELECTRIC LIGHT EQUIPMENT; L. P. Graner, Eindhoven, Netherlands. App. filed June 18, 1923. In which electric lamps and condensers are used on the same circuit.

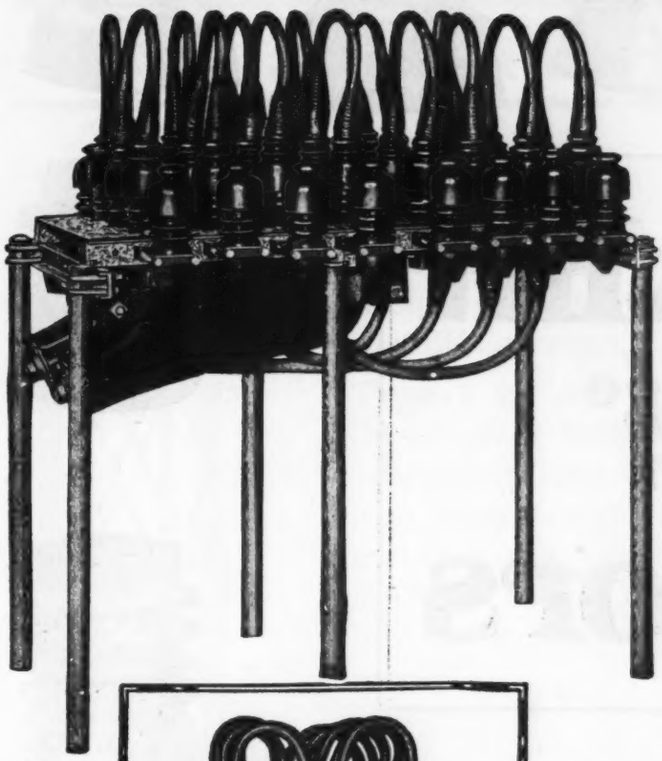
1,652,990. CASING FOR LIGHTNING ARRESTERS; L. R. Golladay, East Pittsburgh, Pa. App. filed Jan. 14, 1927.

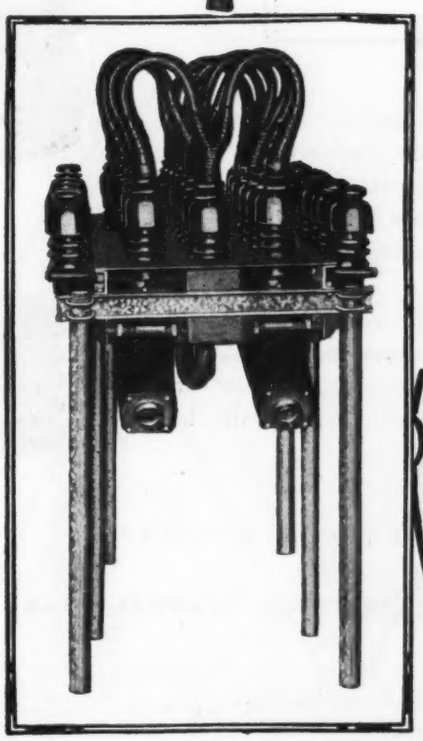
New Trade Literature

MOTORS.—Bulletins Nos. 500, 501, 502 and 503 issued by the Louis Allis Company, Milwaukee, describe and illustrate respectively its multi-speed squirrel-cage alternating-current motors, its totally inclosed externally cooled squirrel-cage motors, its inverted rotary converters and its self-start squirrel-cage motors. The bulletins contain specifications of the various types as well as a number of illustrated applications.

DESIGN OF PULVERIZED COAL FURNACES.—The Combustion Engineering Corporation, 200 Madison Avenue, New York City, has issued a seven page booklet entitled "The Design of Furnaces for Pulverized Coal." The booklet covers such items as the rate of combustion, importance of turbulence, inflammability, etc. Graphs show the ratio of primary air to coal compared with the speed of flame propagation as well as with per cent rating and burner exit velocity.

Transformer Vault Switching Table





A compact, economical unit which will permit a lower outage factor and saves space

For use where the importance of the load does not warrant the G & W Vault Unit or other G & W Oil and Air Break Devices.

Two feeders terminate in the two four conductor potheads which, in turn, feed into a light and power bus (the four single conductor cables in the center) through disconnecting potheads. Feeding off this bus through other disconnecting potheads are the light and power transformer banks. Dummy tubes and caps are conveniently arranged to cover the live parts during disconnection.

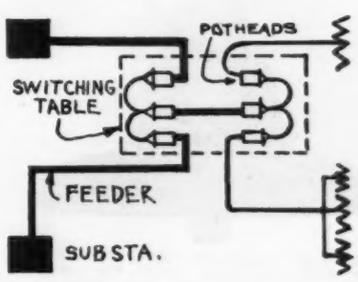
Flexibility Features

1. Two sources of energy can feed into this light and power bus.
2. The two sources of energy can be interconnected as a temporary or a permanent circuit rearrangement as required by system conditions outside the vault.
3. The light and the power banks are fed through separate potheads and are independent of each other.
4. The light transformer can be plugged in on any phase for load balancing of normal feed.
5. The power bank can operate open delta in case of damage to one transformer. The damaged transformer is disconnected by pulling off its disconnecting pothead cap and setting same on the dummy tube.
6. Each transformer is connected independently. Thus a damaged transformer is easily disconnected. The switching table is easily operated. It stands about three feet from the floor. It is easily installed and is generally set in line with the transformers.

The G & W Switching Table provides flexibility not only for the transformer vaults, but for the outside system as well. It is economical of floor space.

The Simplest Way of Taking Care of a Main and an Emergency Feed to a Transformer Bank

G & W
Electric Specialty Co.
7780 Dante Ave., Chicago



G & W ELECTRIC SPECIALTIES

Exactly What You Want!

G & W design and manufacture practically every device for the end of a cable. See Catalog No. 27.

More than Protection G&W for the Cable Ends

POTHEADS AND BOXES

Franklin
High Voltage Porcelain
Insulators

The new pin-type Franklin Porcelain Insulators have well rounded grooves, on both inner and outer surfaces of the shells, of sufficient depth for effective holding of the cement and for allowing a substantial coating of resilient material on all nesting surfaces.

The Franklin plant is equipped for the production of wet process porcelain, exclusively. This plant is modern in every respect and great care is given the selection of raw materials, manufacture, inspection and testing.

Bulletin No. 223 listing the complete lines of one-piece and two-piece pin type insulators, suspension insulators, bushings, etc., is now off press. A copy of this bulletin will gladly be sent on request.

The new suspension type Franklin Porcelain Insulators have the new wedge construction that has, without increase of bulk or porcelain thickness, greatly increased the M. & E. rating of all types.

FRANKLIN PORCELAIN CO.

ELECTRIC SERVICE SUPPLIES CO.

Sales Agents

Home office and plant at 17th & Cambria Sts., PHILADELPHIA; District Offices at 230 So. Clark St., CHICAGO; 50 Church St., NEW YORK; Bessemer Bldg., Pittsburgh; 88 Broad St., Boston; General Motors Bldg., Detroit; 316 N. Washington Ave., Scranton; Canadian Agents, Lyman Tube & Supply Company, Ltd., Montreal, Toronto, Vancouver.

ELECTRIC SERVICE SUPPLIES CO.

MANUFACTURER OF RAILWAY, POWER AND INDUSTRIAL ELECTRICAL MATERIAL

For a variety of uses

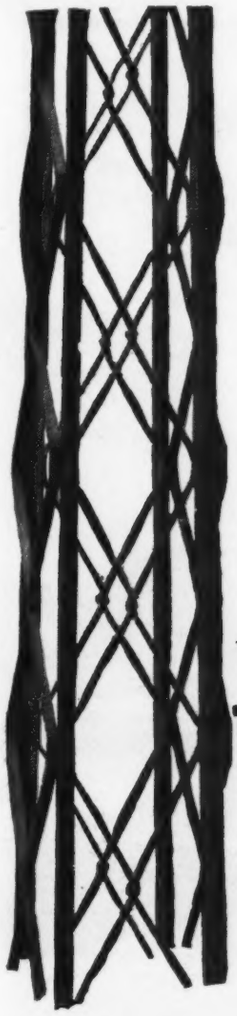
PAGE 7

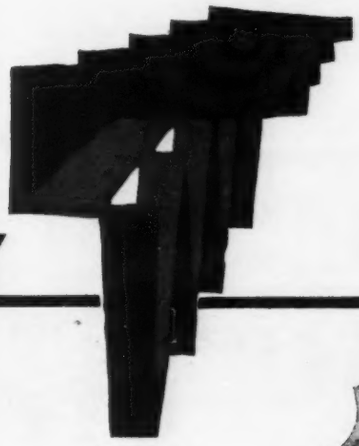
Walter Bates Steel Pole

TYPE 2

The advantages of Walter Bates Steel Poles are many. All four types were designed to meet every Central Station installation need.

Type 2 is ideal for city installation where base width is not limited or where the load will be heavy. It is also most practical for open country installation where long spaces are desirable. Type 2 is rectangular in section and meets all appearance requirements.





End View

Side View

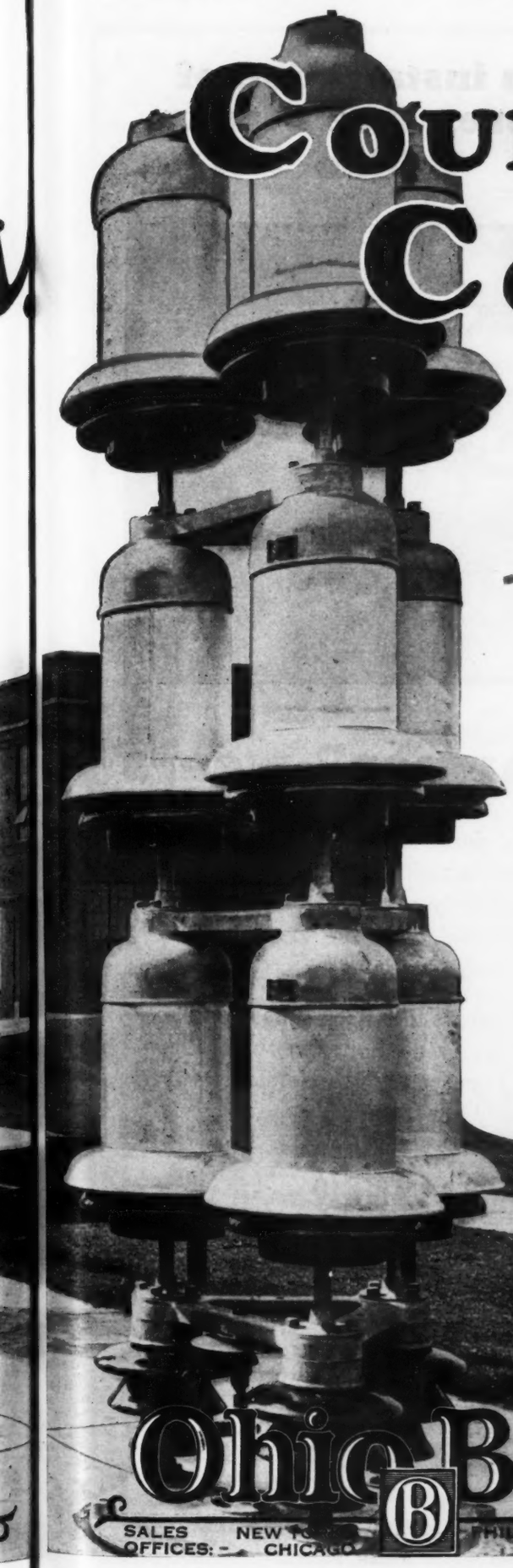
STEEL
POLES
TOWERS
SUBSTATIONS
FLOOR GRATING
and other Steel Products for Utilities

WALTER BATES STEEL CORPORATION

GARY INDIANA.

New York, N. Y. Day & Goater, Inc. 30 Church St.
CLEVELAND, O. E. S. Stickle Company 342 Rockefeller Bldg.
BIRMINGHAM, ALA. Shook & Fletcher Supply Co., Inc., 827 Brown-Marx Bldg.
ATLANTA, GA. E. A. Thornwell Candler Bldg.
EXPORT REPRESENTATIVE: Wonham Bates & Goode Trading Corp. 44 Whitehall St., New York City
BUFFALO, N. Y. E. S. Stickle Company 40 West Seneca St.
DALLAS, TEXAS Jack Milburn 908 Allen Bldg.

220kv



COUPLING CONDENSERS

THESE interesting tower-like structures are O-B electrostatic condensers for use in combination with special telephone equipment for coupling to high voltage power line conductors utilized for telephone carrier current.

The three-unit stacks, in the foreground, are for use on 110-kv. power lines, while the six-unit stacks are for 220-kv. lines. The latter measure over 20 ft. in height and weigh approximately 5 tons each. Capacity in both cases is 1000 micro-microfarads.

These four condensers together with another set of exactly the same size and type, were just recently shipped to The Pacific Gas and Electric Company in California. The larger condensers are to be installed on the 220-kv. lines from Pit River development to the Vaca-Dixon Substation. The smaller units are for the Vacaville-Oakland 110-kv. line.

The telephone apparatus for this installation was developed and manufactured by the Western Electric Company, New York City.

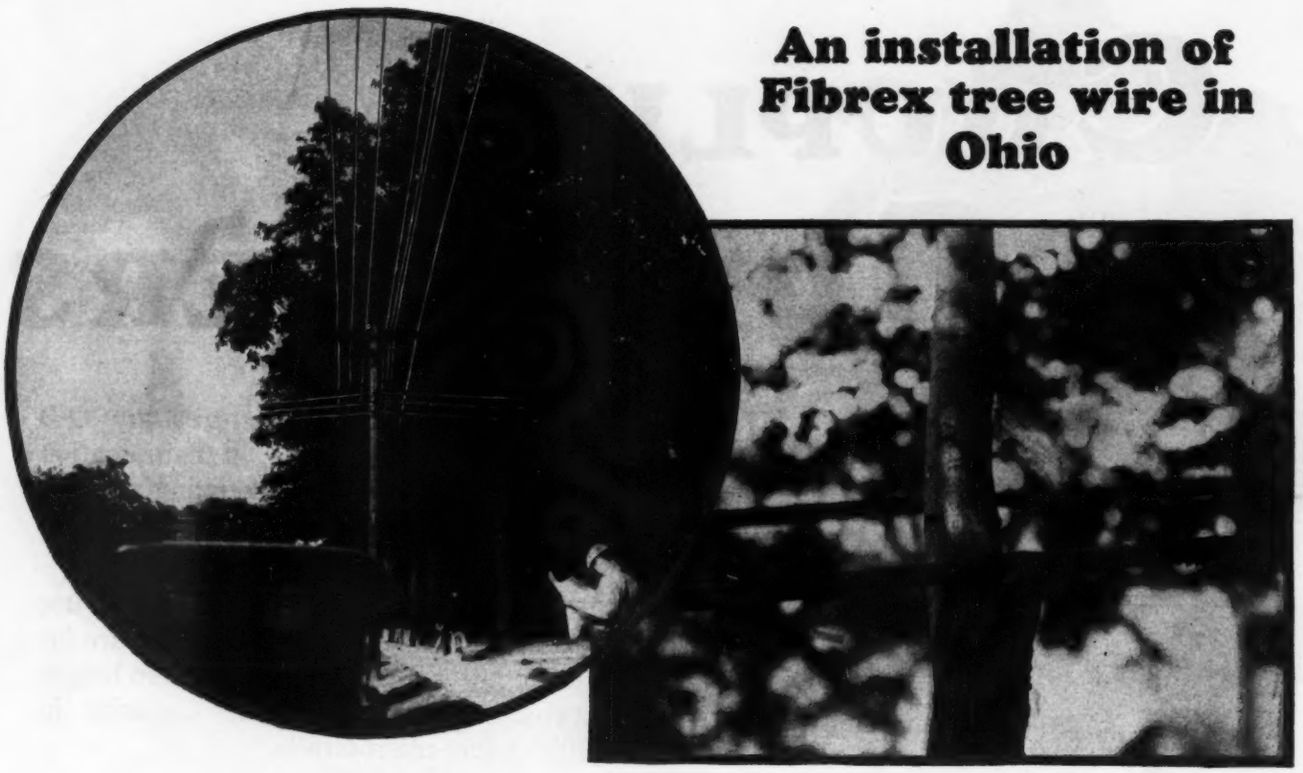
Aside from the interesting engineering and even spectacular aspects of these condensers, their development and manufacture is imposing testimony of O-B pioneering in engineering practices contributing to the advancement of the electric power industry.

Ohio Brass Company, Mansfield, Ohio
Dominion Insulator & Mfg. Co., Limited
Niagara Falls, Canada
771H

Ohio Brass Co.

SALES OFFICES: NEW YORK CHICAGO PHILADELPHIA PITTSBURGH CLEVELAND SAN FRANCISCO LOS ANGELES

PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
CAR EQUIPMENT
MINING MATERIALS
VALVES



An installation of Fibrex tree wire in Ohio

Showing how Fibrex "Armor" wears

The illustration at the right shows how Fibrex Tree Wire wears on the limbs of trees—actually sawing them off in time. Yet, Fibrex shows scarcely any sign of wear. It is slightly frayed on the underside and the weatherproof braid has partly worn off.

Although Fibrex "Armor" wears like steel, it has none of its disadvantages. Give Fibrex a trial on your lines. Get a sample and examine it. Then you will understand why it gives such long dependable service.

The illustration below of a section of Fibrex Tree Wire indicates why it does give long dependable service.

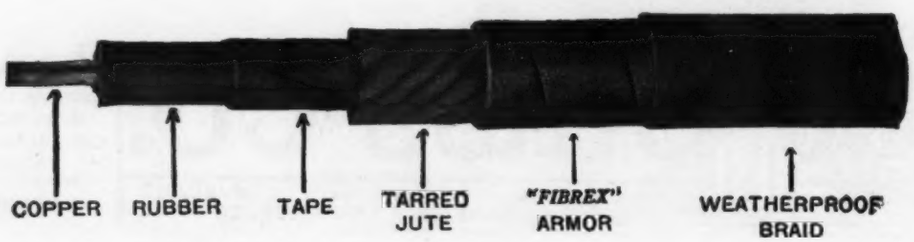
Fibrex Tree Wire consists of a rubber-covered wire insulated for any commercial voltage, over which is applied a heavy rubber-filled tape; then a serving of jute thoroughly saturated with tar; followed by one Fibrex tape, which is the distinguishing feature of Fibrex Tree Wire. Over the Fibrex tape is placed a thoroughly weatherproof cotton braid which gives Fibrex the same appearance as the ordinary line wire into which it is spliced.

SIMPLEX WIRE & CABLE Co

MANUFACTURERS

201 DEVONSHIRE ST., BOSTON

New York Chicago San Francisco
Cleveland Jacksonville



Modern deductions from age old adages!

Handsome is as h.d.

The designer of the Oliver Secondary Rack was pleased—noticeably pleased—when told that it was a BEAUTY.

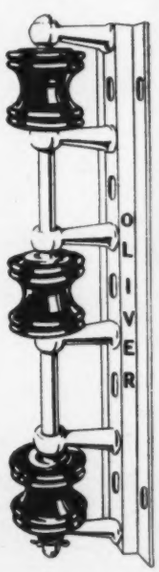
His work was done.

But that's where the rack had to start in to *earn* such a title.

For, you see the Oliver organization knows that the engineers, purchasing officials and linemen judge line material first, last and always by what it DOES, instead of how it looks.

And when the Oliver man calls on them he wants to receive GOOD LOOKS rather than SOUR LOOKS Sometimes called "the icy stare."

And he wants the good looks to accrue from handsome service.



This is it.
This is IT in secondary racks.
See next week's issue for the seven individual features.
Seven handsome improvements and each one DOES something.

Line Material Department

Get your quotation

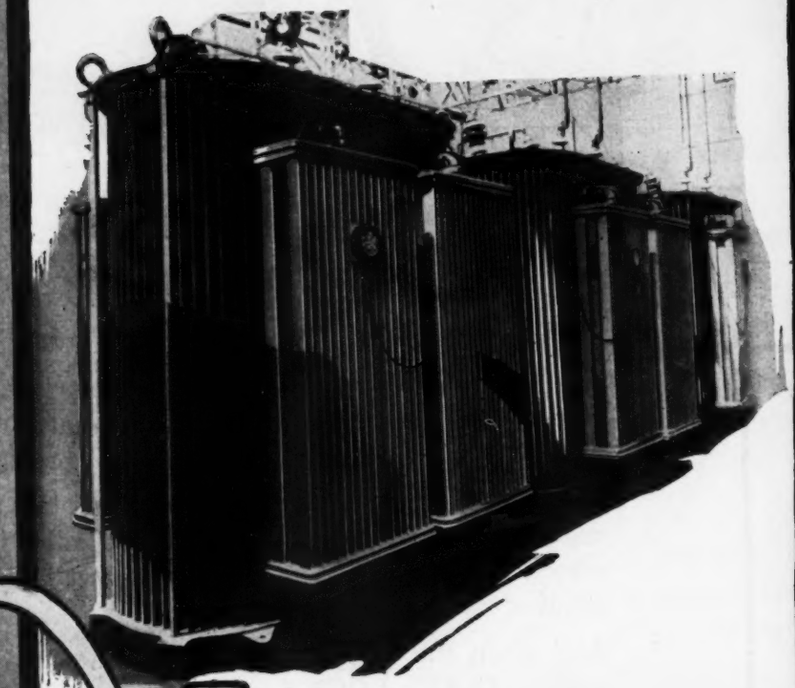
OLIVER

IRON and STEEL CORPORATION

South Tenth and Muriel Sts., Pittsburgh, Pa.

"Oliver the Line"

MOLONEY
TRANSFORMERS



Wherever there are Moloney Transformers economical performance is assured

MOLONEY ELECTRIC COMPANY

Main Office and Factories: St. Louis, Mo. Sales Offices in Principal Cities

LIKE the skyrocket, the Condit Type FO-40 attains enormous acceleration at the "take-off". Multiple breaks in series accentuate its high speed of circuit interruption—one reason why the Type FO-40 is the outstanding breaker for higher voltage service.

CONDIT ELECTRICAL MFG. CORP.
Manufacturers of Electrical Protective Devices
Boston, Mass.

Northern Electric Company
LIMITED
Sole distributor for the Dominion of Canada

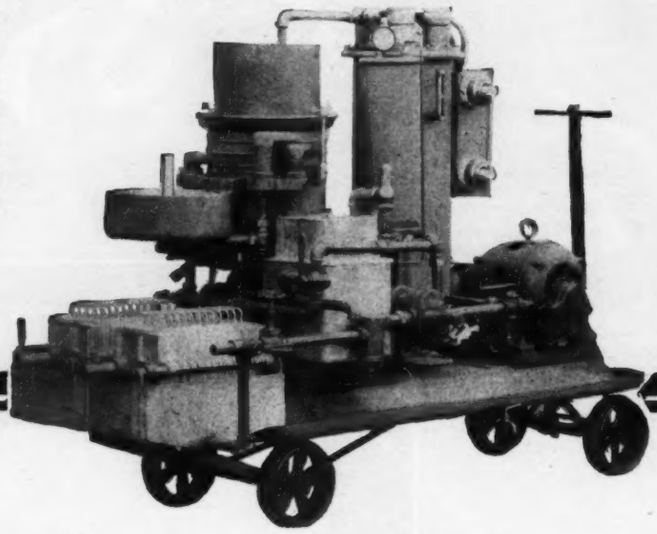
Specifications: 800 Amperes or less; 73,000 Volts; 50,000 Volts; 37,000 Volts. Interrupting Capacity 1,000,000 Kv-a or less. Breaker illustrated is 37,000 Volt B size.

CONDIT

235

There's No Argument Now

The vital necessity of keeping insulating oil for transformers, switches, and circuit breakers, free from pollution of any sort is a known and accepted fact. The next step is to determine the most satisfactory, efficient and economical way of insuring oil against pollution.



The HYDROIL Is Exactly Fitted For Central Station and Industrial Application

The Hydroil is not a cream separator adapted to the needs of industry. It is an industrial machine, designed and built expressly to meet industrial conditions. Compact and complete in every detail, it is entirely self-contained, either in a portable model or stationary installation. The secret of Hydroil economy and efficiency lies in the construction of the "Hydroil-Universal Bowl." The Model F-50 has a capacity of 500 gallons of *de-aerated, dry* oil per hour. The Hydroil delivers a constant stream of purified oil raised to a dielectric strength of over 25,000 volts in a single passage through the machine. The heaters, the centrifugal bowl, the de-aerating device and the filters are all connected in a single line. This enables the oil to be drawn from its tank, run through the Hydroil where it is *completely reconditioned* and put directly back into use. Complete information with prices will be sent to you from our nearest sales office.

Complete oil purification in one continuous passage

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SALES CORPORATION
LEBANON, INDIANA

Power Equipment Company,
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No. 633
Recommended Working Load, 9000 pounds. Rated Combined M. and E. Strength, 27,000 pounds. Reserve Strength Ratio 3:1

Today's

Super-Dreadnaught

NOT so many years ago, a ship was designed that seemed to be the ultimate in naval armament. It was called the dreadnaught. Then the super-dreadnaught made its debut—progress made the dreadnaught as out-of-date as milady's last year's bonnet.

Progress in insulator design requires keeping pace with changes in transmission-line practice. Insulators that met the conditions of ten years ago with ample reserve strength for long life, have no safe reserve left under modern stresses. Today's tendency for longer spans, heavier cable, higher voltage, and other super-power requirements must be taken into consideration.

Westinghouse insulators have that reserve strength necessary to assure long life on transmission lines as built today.

Westinghouse Electric & Manufacturing Company
Westinghouse High-Voltage Insulator Works
Derry, Pa. Emeryville, Cal.
Sales Offices in All Principal Cities of the United States and Foreign Countries

Porcelain
you can install *– and forget*

— because science — not tradition—governs the making of all Westinghouse porcelain and insulators.

— precision processes, at every stage, are the rule.

— never is anything taken for granted at any time.

— even slight variations in materials are compensated for.

First the design—then the materials—then the method—and then, a vigilance that permits no compromise.

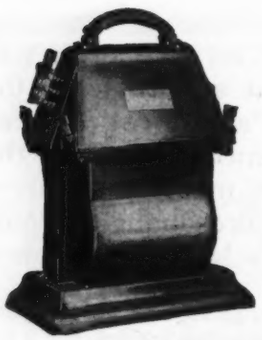
Insulators with Reserve Strength

Westinghouse

X91092

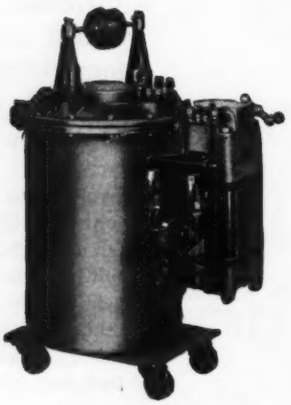
PERIODIC inspection and tests of insulating oil and the dehydrating and purifying of oil that has accumulated moisture or sediment should not be neglected. This is recognized by all who experience the most successful operation of equipment that depends upon insulating oil. Where oil maintenance is systematic, failures

Testing



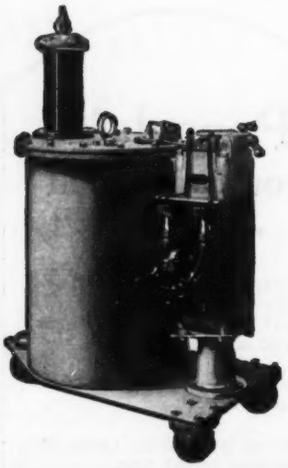
For Field Use

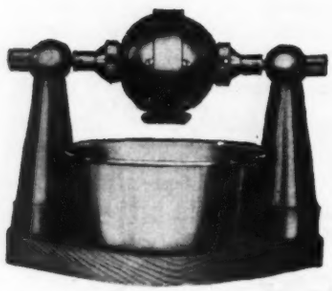
G-E Portable Oil-Testing Set, especially for field use, weighs only 50 lbs. complete. It has voltage taps of 15, 17.5, 20, 22.5 and 25 kv.



For Laboratory Use

G-E Oil and Insulation Testing Sets, semi-portable, designed for research and experimental work. Voltage control by induction regulator permits gradual rise in voltage from zero to maximum without surges or appreciable wave distortion. Capacities: 30,000 volts, 3 kv-a.; and 50,000 volts, 4 kv-a.





Separate Oil Spark Gap

For those who already have a high-voltage testing set, a spark gap is supplied as a separate unit, including a heavy spun brass pan into which the tested oil can be emptied by revolving the gap.

For Drum Testing

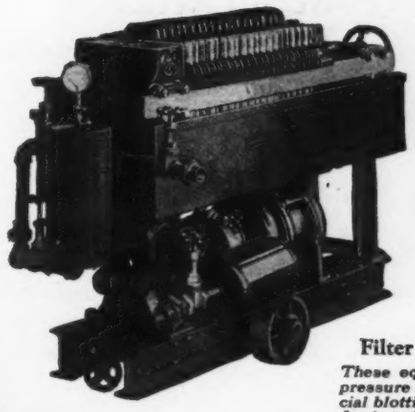
The G-E Drum Oil Tester can be used with any 25-30 kv. testing transformer except those which have the mid-point of their high-voltage winding grounded. With this tester oil in drums can be tested without drawing samples.

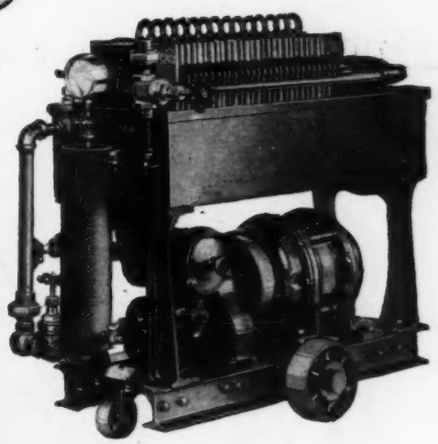
GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

of apparatus from burnouts, with consequent interruption of service, are minimized—and economy in the use of oil invariably results. G-E Oil Purifying Equipments are designed for both purifying and dehydrating oil, especially that used in transformers, oil circuit breakers, regulators, etc. All are of standard G-E quality.

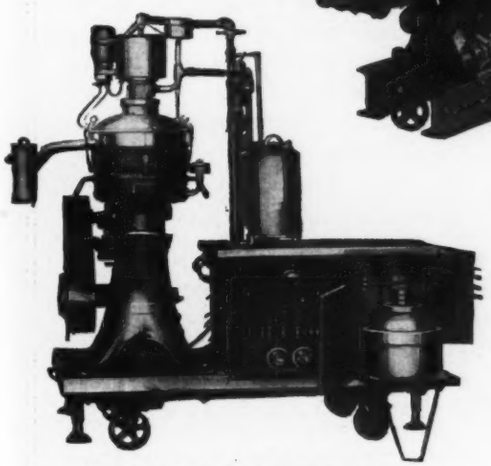
Purifying





Filter Presses for Dehydrating

These equipments force the oil under pressure through several layers of special blotting paper—the ideal method of freeing oil from suspended moisture and sediment. Both will raise the oil to high dielectric value with one passage. Standard sizes use 7-inch and 12-inch paper, filtering at a rate of approximately 10 gal. per minute and 30 gal. per minute respectively. Ovens for thoroughly drying the filter paper are recommended and furnished as a part of this equipment.



Special GE—DeLaval Purifier

A centrifugal machine specially designed for both the purification and dehydration of insulating oil. It is always ready to operate, is economical and requires no filter media. It is recommended to those who prefer the centrifugal method of purifying the oil in G-E Transformers including conservator types. Used in conjunction with G-E Oil Filter Press, it is recommended for the more difficult reclamation and maintenance of oil used in circuit breakers.

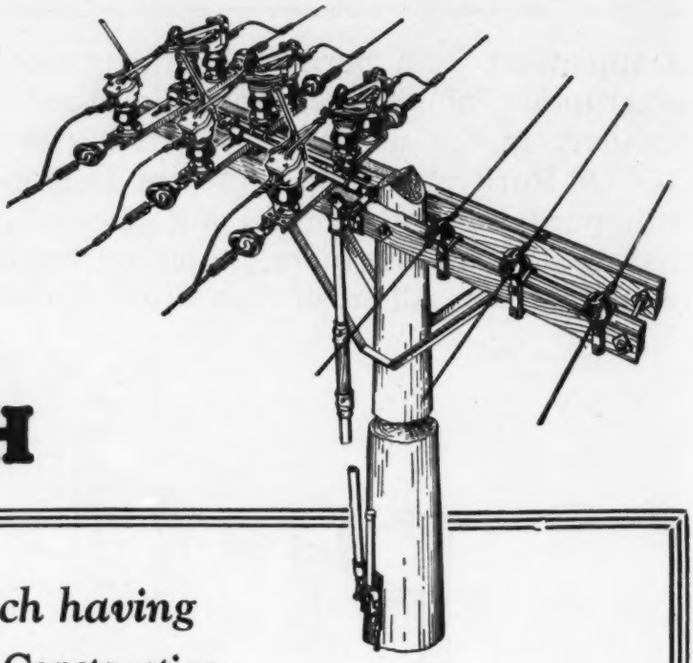
General Electric, after much co-operative research with oil refiners, is well equipped to cope with the problems of oil maintenance. The G-E Equipment available for this work is complete and is highly recommended. Bulletin 49709 fully describes this line and presents information as to the requirements of the apparatus and the characteristics of the different oils used. It also makes recommendations as to the best methods of inspecting, testing, drying, and purifying.

405-2

ELECTRIC

SALES OFFICES IN PRINCIPAL CITIES

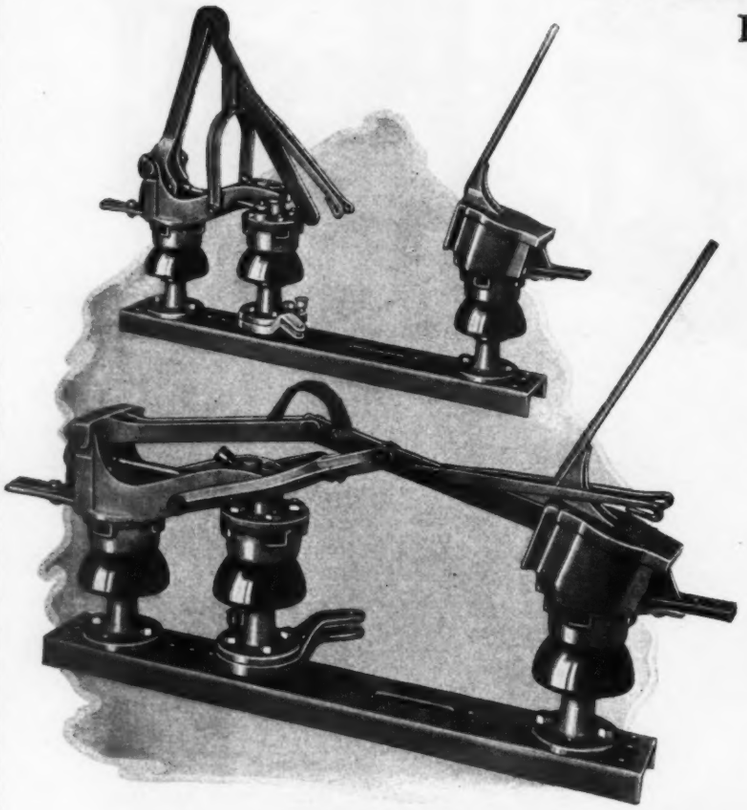
Mount it on double crossarms



—the PANTOGRAPH

A 2200 to 7500 Volt Switch having

Rugged Construction
Powerful Action
Easy Operation



THE SUCCESS of the Pantograph Switch for higher voltages was father to the idea of bringing out this smaller size for 2200 to 7500 volt service.

Users of the Pantograph on higher voltages realized that they were getting switch dependability and convenience, never before considered possible, and they wanted to extend these advantages to their distribution lines also. So they asked for a Pantograph for 2200 to 7500 volts, and got it.

A rugged switch that can be depended upon to open or close easily under any and all conditions, even when covered with sleet, is a source of great satisfaction to all operating men. And the Pantograph is that kind of a switch.

Did you receive a copy of our Pantograph Bulletin 208? If not, a card to us will bring one by return mail.

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Japan, T. Hasegawa Co., Osaka

Cable of Quality

When a reel of G-E Cable leaves the factory it represents more than so much copper and covering. It combines scientific selection of many materials, fabrication of these into a perfect whole, and a rigid test that has stamped the product with G-E approval. To the user it carries full assurance of long and satisfying service.

Cable for
—any voltage
—any capacity
—any service

810-4

GENERAL ELECTRIC

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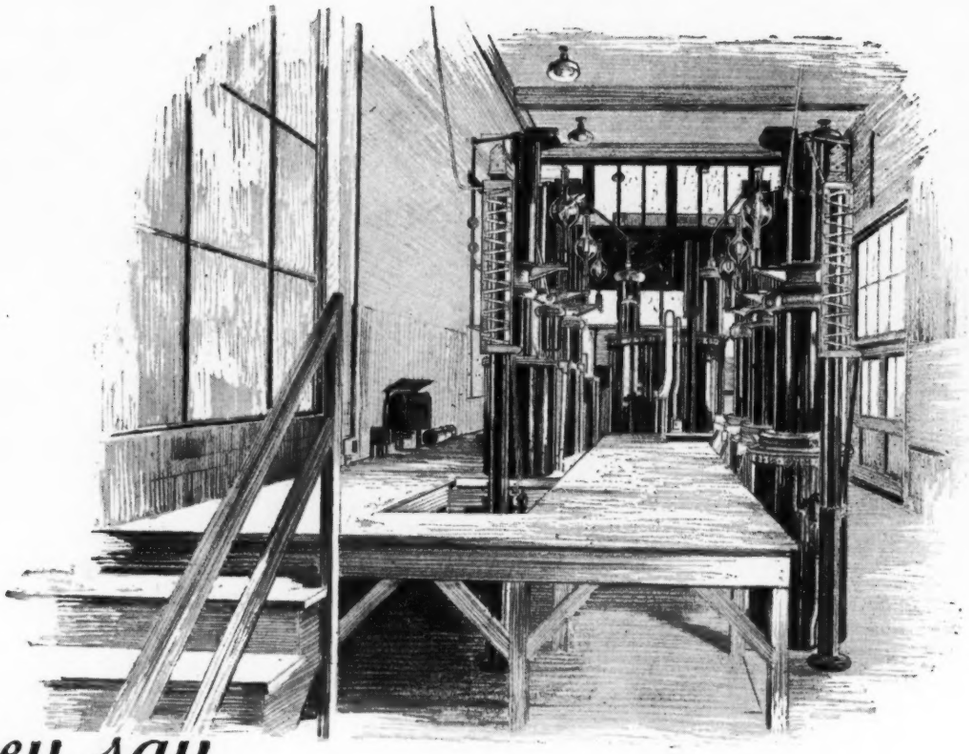


When they say

Raise the voltage of our underground transmission

This calls for cable-testing facilities, to produce high-voltage direct currents—up to 400,000 volts or more.

General Electric is especially equipped to supply the special high-voltage testing transformers, and complete kenotron rectifiers together with accurate measuring equipment for the delicate currents and high potentials.

With its own high-voltage laboratories in daily operation, and having made many successful installations of testing equipment, for voltages up to 2,100,000 volts alternating current and 400,000 volts direct current, this Company has definitely established its leading position.

The same is true of its position with regard to the manufacture of all other transformer and accessory products. Make General Electric your base of supply.

General Electric's position as a builder of equipment for transmission and distribution is unique. Not only can G-E Transformer Products be supplied for every normal requirement, but a service is available to study any special problems, and, if necessary, develop the equipment required to deliver reliable power in suitable form.

GE Transformer Products
— the Standards of Quality

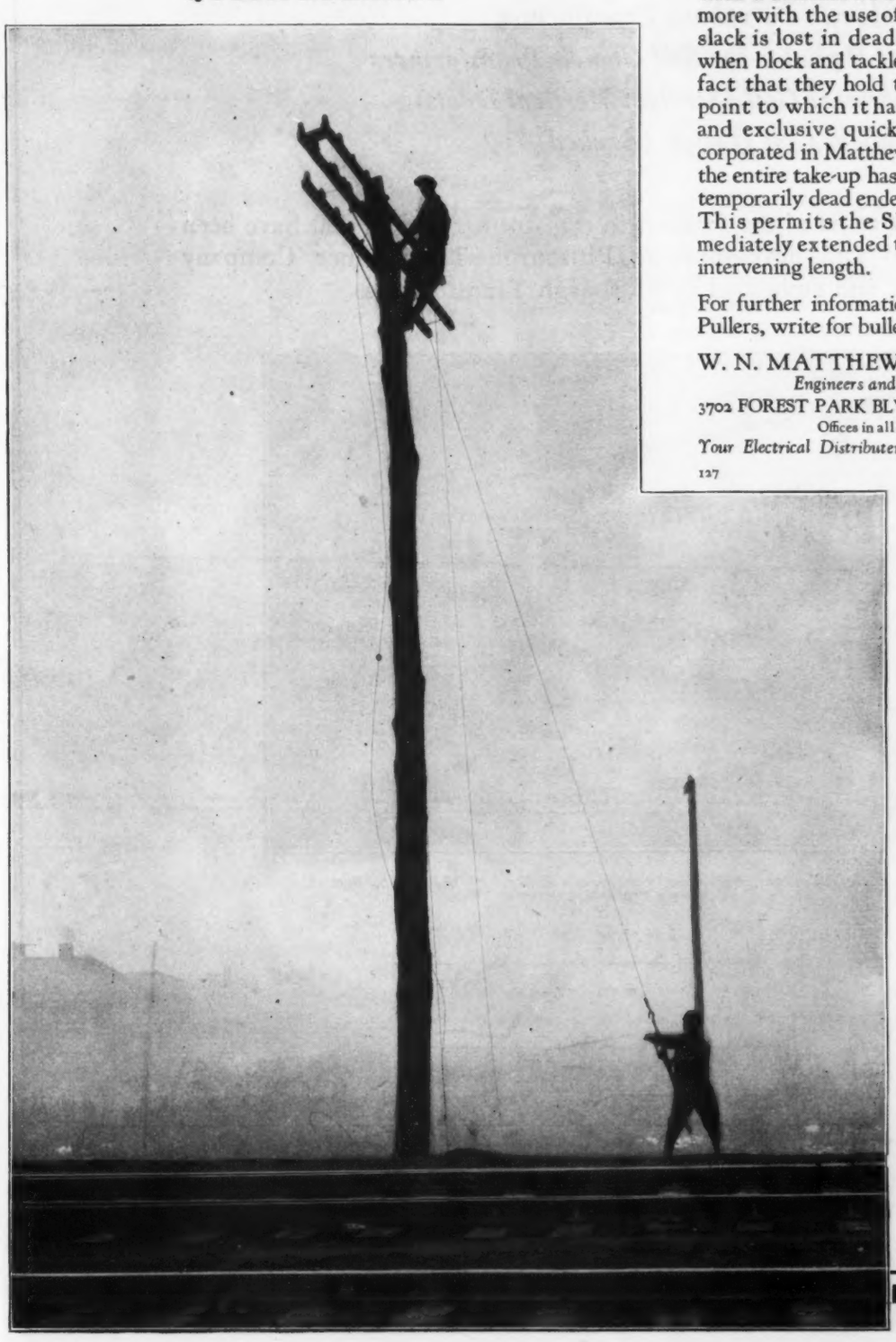
405-13

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

MATTHEWS SLACK PULLERS

QUICK RELEASE



Take Up Slack *this quick easy way*

Originally designed for pulling slack from conductors and guy wires, Matthews Slack Pullers now are put to many uses such as changing disc insulators, pulling sag out of underground cables and splicing in new sections of transmission line wires. With its geared ratio, one man can pull as much strain with a Matthews Slack Puller as four or more with the use of block and tackle. No slack is lost in dead ending, as is the case when block and tackle is used, because of the fact that they hold the strain to the exact point to which it has been pulled. A new and exclusive quick release feature is incorporated in Matthews Slack Pullers. When the entire take-up has been used, the wire is temporarily dead ended and the lock released. This permits the Slack Puller to be immediately extended to its maximum or any intervening length.

For further information on Matthews Slack Pullers, write for bulletin 701.

W. N. MATTHEWS CORPORATION
Engineers and Manufacturers
3702 FOREST PARK BLVD. ST. LOUIS, U. S. A.
Offices in all Principal Cities
Your Electrical Distributer Can Supply Them To You

127

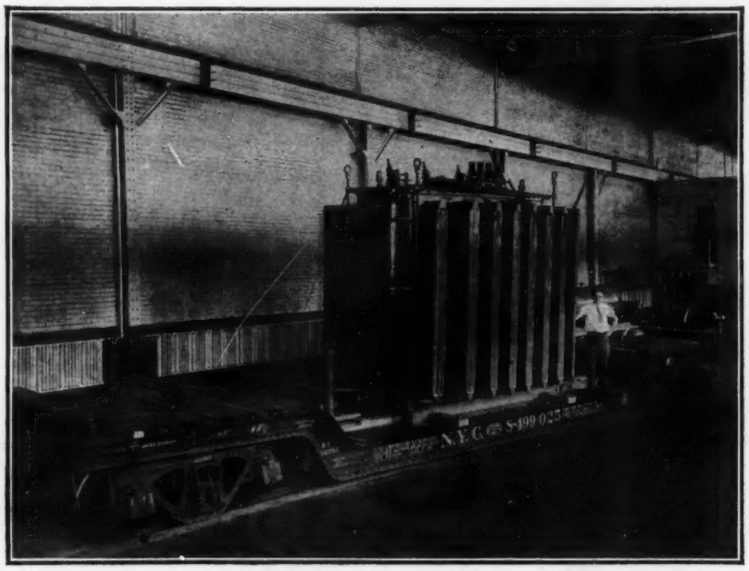
Matthews Slack Pullers are now obtainable in two sizes, the largest having a 10,000 pound maximum pull with a 26" take up. The smaller has a 3,000 pound maximum pull with an 18" take up.

The Matthews Strainometer is a dependable device for measuring the strain exerted on the wire or guystrand. The strain bolt is graduated, each graduation denoting 500 pounds strain. Quickly attached to either end of Slack Puller.

The Pioneer in Transformer Manufacture

All-Steel Case for Transformers (Copper Alloy Steel)
Pittsburgh Polyphase Transformer
Film Radiator for Self Cooled Transformers
Ventilated Coil (Straight Vertical Ducts)
Elliptical Coil Design (Arched)

These are some of the features in transformer design that have been originated and developed by Pittsburgh Transformer Company engineers, and embodied in Pittsburgh Transformers.



Large Pittsburgh Polyphase Transformer Ready for Shipment on Special Depressed Center Transformer Car.

When you have the specifications ready for your next order for transformers, let us submit proposal on Pittsburgh Transformers.

Pittsburgh Transformer Company

Largest Manufacturers of Transformers exclusively in the United States

Pittsburgh, Pennsylvania

—An eel Couldn't Slip on BLAW-KNOX SECURITY STEEL GRATING & FLOORING

—much less a pedestrian. Note the twisted cross bars which are slightly raised above the bearing bars. Their roughened edges present a traction surface unequalled by any other form of grating.

Note, too, that BLAW-KNOX Security Grating is truly one-piece; not put together with bolts or rivets, not cut, slotted or punched, nothing to become loose and rattle.

The twisted bars are united with the bearing bars at intersections by ELECTRO-FORGING under enormous pressure.

Because of its design and method of fabrication, BLAW-KNOX Security Grating and Flooring can be perfectly galvanized and painted. There are no crevices left unprotected to invite corrosive action.

Note the clean-cut rectangular openings which assure maximum light and ventilation, also cleanliness because there are no acute angles to collect debris.

BLAW-KNOX Security Grating and Flooring is used for:

Stairways, steps, and landings.
Runways of all sizes and descriptions.
Flooring in power houses and other industrial buildings, floors of ships, etc.
Ventilating shafts and hatchways.
Fire escapes and for
Miscellaneous Industrial Uses.

Catalog on request.

Attractive territories are still open for high class distributors.

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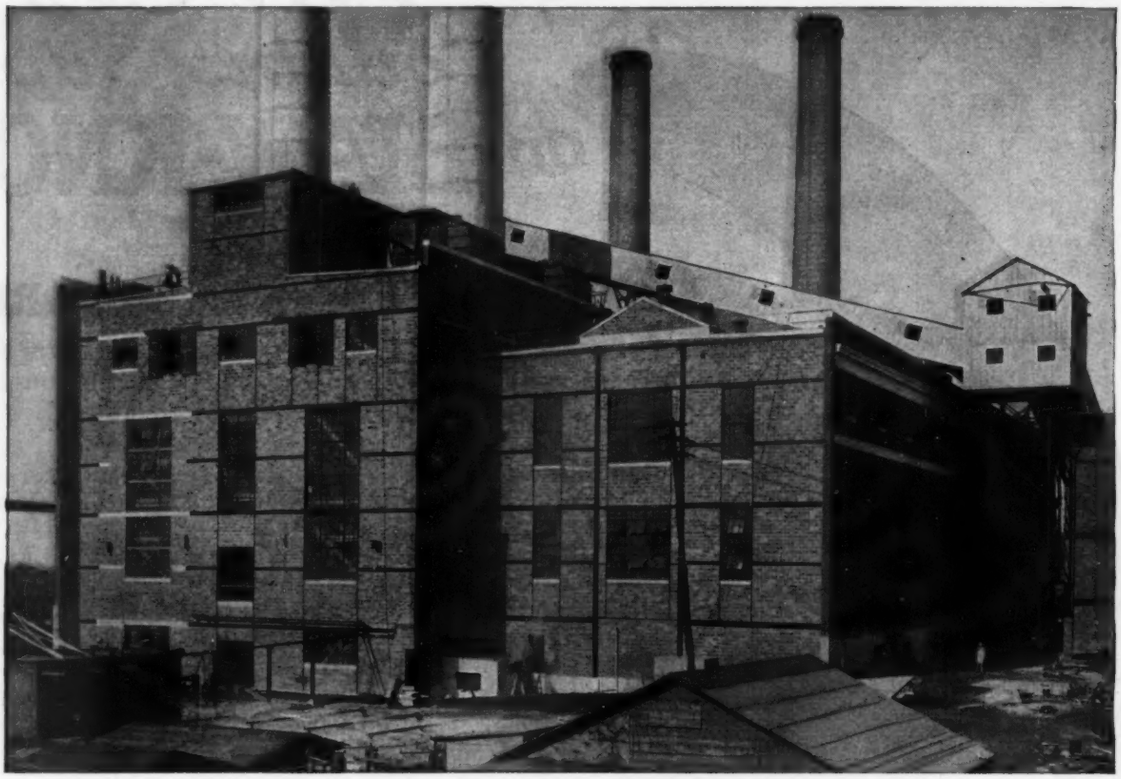

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40,000 H. P. Addition and Improvements

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Extending and modernizing power stations usually must be done while stations are in service. This work, requiring both extensive operating and long construction experience, is an important part of Stone & Webster service.

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Fourth Edition

(Revised to October 1, 1927)

of

The BONBRIGHT SURVEY *of* ELECTRIC POWER *and* LIGHT COMPANIES

of the United States

Just off the Press

THIS SURVEY presents a series of maps and tables by means of which an electric company is identified with every city and town comprising the urban population of the United States. The capitalization and earnings of the companies are set forth in tabular form.

There are several sources of information to which an inquirier may turn to ascertain the towns and cities served by the particular com pany in which he is interested. This is the only compilation which enables the reader to do the reverse, and, by looking up the name of any incorporated town or city in the United States of 2,500 population or over, to find the name of the company serving it with electrical energy and to obtain a picture of the territory and the neighboring companies.

A few characteristic facts about each state are included in the volume so that the general type of activity of the inhabitants of the territory may be quickly visualized. The relative size of the cities and their rate of growth are also presented as an indication of the trend of power demand.

Arranged according to Geographic Divisions

Section I—New England
Section II—Middle Atlantic
Section III—East North Central
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Section V—South Atlantic
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Section VIII—Mountain
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THE book is especially valuable to executives of central station companies, manufacturing concerns, investment houses, banks, trust companies and insurance companies.

1. It is a handbook of the financial standing and structure of the operating companies of the industry.
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4. Used in conjunction with the McGraw Central Station Directory it forms a complete picture of the administrative, financial and engineering structure of the individual units of the electric light and power industry.

Copies of the survey will gladly be sent on approval if desired.

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The solution to your problem of greater economy—

in power generation, may not necessarily be in replacement with more efficient equipment, but in the *proper arrangement and operation of your present equipment!*

Many times a simple suggestion by a Competent Consulting Engineer effects such greater economies that the reasonable cost of his services are more than justified.

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Consult the Advertisements in This Directory of Engineers when in need of Consulting Services!

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POSITIONS VACANT

ELECTRICAL engineer with inventive turn of mind to take care of original design and supervise the development of magnetic switches, relays, remote control apparatus, air circuit breakers, etc.; excellent opportunity for a capable experienced engineer who can produce results; state age, education, experience and salary expected; location, Middle West. P-270, Electrical World, 401 Guardian Bldg., Cleveland, Ohio.

MAN wanted to write service manual, owners' instructions, etc.; automotive electrical experience preferred; state age, education, experience and salary expected. Address Box 1027, Rochester, N. Y.

1925-26 ELECTRICAL engineering graduate to be trained for sales position; opening exists for man of exceptional ability. The Electric Controller & Manufacturing Company, 2700 East 79th St., Cleveland, Ohio.

EMPLOYMENT SERVICE

IF YOU are qualified for position between $2,500 and $25,000, and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established seventeen years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not an employment agency. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 262 Main Street, Buffalo, N. Y.

$3,000-$30,000 men find our service effective in making connections individual. Confidential. Refund agreement. Not agency. Jacob Penn, Incroporated, 9 Park Place, New York.

EMPLOYMENT AGENCY

We need at once first-class steam and electrical power plant designers. Also other openings for experienced draftsmen and designers, mechanical and electrical. Consolidated Agencies, Inc., 110 South Dearborn Street, Chicago, Ill.

POSITIONS WANTED

COMMERCIAL manager, experienced in power, lighting and appliance sales, with gas, electric and ice utilities; successful with campaigns and supervision of salesmen; university graduate; age 32 years, married; at present employed, but available on reasonable notice. PW-267, Electrical World, Bell Telephone Bldg., St. Louis, Mo.

WANTED
METER TESTER
State Full Particulars and Salary Expected.
P-273, Electrical World,
Tenth Ave. at 36th St., New York City

POSITIONS WANTED

ELECTRICAL-MECHANICAL engineer, 12 years' experience in design and sales of motors and transformers and 4 years' experience as shop superintendent in charge of manufacture of motors and control equipment. College graduate, married, 41 years old. At present employed, but desire change with growing concern. Middle West preferred but would be willing to consider any location. PW-251, Electrical World, Tenth Ave. at 36th St., New York.

EXECUTIVE or sales engineer, experienced installing, construction, appraisal, purchasing, sales; open for immediate connection anywhere; all correspondence acknowledged. Manager: Bice Engineer Co., Goffstown, N. H.

METERMAN with eight years' experience, desires position. Primary meter installation and maintenance speciality. Capable of handling meter department. Married, age 27. PW-276, Electrical World, Bell Telephone Bldg., St. Louis, Mo.

UTILITY man with eighteen years' of experience in electric utility management, operation and construction. Now employed, but desires change. Good references. PW-277, Electrical World, 7 So. Dearborn St., Chicago, Ill.

1925 graduate desires position. Two years' experience in overhead and underground distribution and transmission. Available at once. PW-256, Electrical World, 1600 Arch Street, Philadelphia, Pa.

SALESMAN WANTED

Salesman or Sales Engineer
Wanted for high voltage insulators and lightning arresters by large Eastern sales manufacturing company, part traveling; good future for right man; state technical education, experience, salary and all details; confidential. SW-272, Electrical World, 1600 Arch St., Philadelphia, Pa.

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EARN MORE

Use your spare time to help you to a better job. Central stations everywhere pay high salaries to men expert in inspecting and testing meters. **"I got a job here as Meter Expert at a salary of $250.00 per month and give your course in Meter Engineering, which I am studying, the credit for it."—G. R.**

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We invite inquiries from utilities companies now in the process or contemplating expansion, that are desirous of securing additional capital through the sale of common and preferred stocks.

A thoroughly trained sales organization with a successful sales record of this type of securities is available.

Correspondence confidential.

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Here's Your Chance to Buy Established Business for $10,000.00 with no debts
Has netted in the past five years over $6,000 per annum. For particulars address.
P. J. MINCK, P.O. 3413, Tulsa, Oklahoma

WANTED

WANTED
METERS
110-220 volt
Used D.C. Westinghouse or General Electric
W-274, Electrical World,
Tenth Ave. at 36th St., New York City

Buying Good Used Equipment

is frequently the difference between having good needed equipment or doing without it.

J. L. HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT

801-807 Williams St. North Bergen, N. J.

Telephones: Palisade 2600-2601

MOTOR GENERATOR SETS

1—250 kw., 250 v., G.E. Generator, 3 ph., 60 cy., 2200 v. synchronous motor.
200 kw., 600 r.p.m., 250 v. Gen., 3 ph., 60 cy., 440/2200-v. synchronous motor.
150 kw., 600 r.p.m., 250 v. Gen., 3 ph., 60 cy., 220/440 v. G.E. synchronous motor.
1—125 kw., 250 v. Westinghouse synchronous generator motor set.
1—100 kw., 125 v., D.C., 220/440 A.C., G.E. synchronous motor generator set.
100 kw., 250 v. Gen., 900 r.p.m., 2200 synchronous motor.
1—75 kw., 250 v. Generator, 3 ph., 60 cy., 2200 v. synchronous motor.
1—50 kw., 250 v. Westinghouse, 3 ph., 60 cy., 220/440 v.
1—37½ kw., 900 rev., 110 v., D.C., on same base with 60-hp. Lincoln 220 v., sq. cage motor.
0-20-25-40 kw., 125 v. Exciter Sets.
0-20-30 kw. Balancer Sets.
—5 kw. Battery Charging Sets.

TRANSFORMERS

4—150 kw., 4150 v., 120/240 Pittsburgh Oil Cooled Transformers.
15—5 kw. to 30 kw., 3 ph. Pole Type, 2200/1100 440/220/110 G. E.

A. C. GENERATORS

No.	*Kw.*	*Rpm.*	*Volts*	*Ph.*	*Type*
1	300	450	2300	3	G. E. P.
1	0	600	440	3	Westg.
2	150	600	220/440/2200	3	Wagner
2	100	900	2300	3	G. E.
1	75	900	2300	3	G. E.
1	50	1200	220/440	3	G. E.

A. C. ENGINE GENERATOR SET

1—25 kw., 125/250 volt, 3 wire General Electric Gasoline Engine Set, new.

MOTORS—3 PHASE, 60 CYCLE

	Hp.	*Rpm.*	*Volts*	*Type*
1	500	360	220/440	Westg. HF. sl.rg.
1	400	450	2200	G. E. synch.
	300	300	2200	Westghse. synch.
4	200	514	4150/2300	G. E. synch.
1	180	400	440/2300	Burke sl.rg. 3 brg.
2	175	600	220/440/2200	Wagner synch.
1	150	900	2300	G. E. synch.
1	150	600	2200	Westghse. sq. cage
1	50	600	2200	G. E. MT. sl. rg.
1	150	1200	220	Elec. Machy. syn.
1	150	1800	2200	Westg. sq.cg. motor
1	25	900	440/2200	Cr. Wheeler
1	100	900	440/2200	G. E.
1	100	900	220/440/2200	West.
1	75	600	220	G. E. sq. cg.
1	75	720	220	Westg., C.W.
1	75	490	440	Allis-Chal. S. R.
1	75	900	2200	G. E. KT.
1	60	1200	220	G. E. sl. rg.
1	60	300	220/440/2300	Fair.-M. Syn. Mtr.
3	50	900	220	G. E. sq. cg.
1	50	900	2200	G. E. B.
1	50	1200	220/440	Wagner sl. rg.
1	40	1700	220/440	Westghse. sl. rg.
1	25	1200	440	G. E. K.
1	25	900	220	West C. S.
1	7½	900	220/440	G. E. MT.
2	2	1800	220/440	G. E.

(2 Phase Motors on request)

BRAND NEW MOTORS

8	7½	900	220-440	Gen. Electric	MT
1	10	1200	220-440	Gen. Electric	MT
3	15	1200	220-440	Gen. Electric	MT
1	15	1200	220-440	Gen. Electric	KT
5	25	600	220-440	Gen. Electric	KT
3	25	900	220-440	Gen. Electric	KT
1	30	900	220-440	Gen. Electric	KT
3	30	1200	220-440	Gen. Electric	KT
1	40	1200	220-440	Gen. Electric	MT
1	40	900	220-440	Gen. Electric	KT
1	40	1200	220-440	Gen. Electric	KT
1	60	720	220-440	Gen. Electric	KT

D. C. GENERATORS—250 VOLT

No.	*Kw.*	*Rpm.*	*Type*
1	250	450	G. E.
1	200	500	West.
1	150	600	G. E.
1	100	720	G. E.
1	75	450	Diehl
1	50	600	Westghse.
1	30	1000	Westghse.

(Smaller sizes on request)

D. C. GENERATORS—125 VOLT

5, 10, 20, 22, 35, 50, 2-100 kw.
3—21 kw. 1250 r.p.m. Sprague

D. C. MOTORS—230 VOLT

No.	*Hp.*	*Rpm.*	*Type*
1	350	450	G. E.
1	200	550	West.
1	150	1100	West. SK
1	100	625	Westg. type S.
1	80	500	Allis-Chalmers
2	75	475	Westg. type S
1	50	560	Westghse SK
1	50	200	Diehl
1	50	650	Sprague
1	40	400	Diehl
1	40	1300	Diehl
1	35	200	Diehl
1	35	700	Cr. Wheeler
1	35	420	Diehl
1	20	665	Diehl
1	20	200	Diehl
1	20	900	Diehl
11	15	1050	Cr. Wheeler CM
8	10	375/750	Westg. S. var.sp.
	10	1350	Rochester

(Smaller sizes on request)

D. C. MOTORS—125 VOLT

1	150	600	G. E.
1	100	675	G. E.
1	80	600	G. E.
3	25	1200	Sprague
1	20	650	G. E.
1	15	775	SK Westghse.

You can save money by our quick

CHANGE-OVERS

Our skilled organization has made rapid changes from 2 to 3 phase A.C. to D.C. or 25 to 60 cycle or vice versa for many of the largest power companies throughout the country. In practically every case we have saved them money. We will gladly send details on request.

Our engineering staff will gladly co-operate with you in laying out and estimating on any contemplated changes. Call on them any time. See our advertisement in the January 14th issue for bargains in 25 cycle items.

GUARANTEE

All apparatus sold, new or used, carries our guarantee to correct by repair or replacement, at our expense, all electrical and mechanical defects occurring in such apparatus, for a period of one year after date of shipment. BERGER BROS. (F. O. B. Rochester)

BERGER BROTHERS

91 St. Paul St.,
ROCHESTER, N. Y.

A. C. Engine Units

1—300 kw., 375 kva., General Electric 3 ph., 60 cy., 240/480 v., 150 r.p.m. Alternator, direct connected to 21x30 side crank 4-valve heavy duty Erie Ball Engine. Unit installed new in 1923—exceptional condition, instant shipment.
1—300 kw. Allis-Chal. 3 ph., 60 cy., 240/480 v., 150 r.p.m. direct connected to 20x32 Rice & Sargent 4-valve engine.
1—180 kva. General Electric 3 ph., 60 cy., 2300 v. (can reconnect for 240 or 480 v.), speed 200 r.p.m. direct connected to 17½ x20 Ames Unaflow engine. Built in 1922.
1—150 kva. Westg. 3 ph. 60 cy. 2300 v. (can reconnect for lower voltage) 225 r.p.m. direct connected to 17x18 right-hand Ames Unaflow engine. Built in 1923.
1—125 kw. Ft. Wayne 3 ph. 60 cy. 2300 v. (can reconnect for lower voltage) 225 r.p.m. direct connected to 14½ x16 Harrisburg Fleming 4 valve engine.
1—90-kw. Ft. Wayne 3 ph. 60 cy. 2300 v. (can reconnect for lower voltage) 277 r.p.m. direct connected to Erie Ball side crank single valve automatic engine.

A.C. Turbo Units

1—12,500 kva., 10,000 kw. Westinghouse 3 ph., 60 cy., 2300 v. 1800 r.p.m. condensing.
1—3125 kva., 2500 kw. G. E. 3 ph., 60 cy., 2300 v., 3600 r.p.m. surface condenser.
1—1562 kva., 1250 kw. G. E. 3 ph., 60 cy., 2400 v., 3600 r.p.m. surface condenser.
1—625 kva., 500 kw., G. E. 3 ph., 60 cy., 2300 v., 3600 r.p.m. condensing.
1—375 kva., 300 kw. G. E. 3 ph., 60 cy., 2300 v., 3600 r.p.m. condensing.
1—187 kva., Westinghouse 3 ph., 60 cy., 480 v., 3600 r.p.m. non condensing.
1—75 kva., Burke Moore 3 ph., 480 v., 3600 r.p.m. non-condensing.

Send for Full List Electrical and Steam Machinery of Every Description.

ARCHER & BALDWIN, Inc.

126 Liberty St., New York City Telephone—Rector 4025

Why responsible central station customers come back for more

Most of our customers are old customers. Why do they "Come back for more"?

Simply because they have found our work entirely satisfactory, and our service a good deal better than they expected. We have the facilities for rewinding and rebuilding transformers in accordance with factory standards, and we specifically guarantee our work electrically correct. You save from 30% to 60% on the cost of similar new equipment.

Write for our Monthly Bulletin, giving rewinding prices and listing about 4,000 rebuilt units in all sizes from 1 to 1,000 kva., 110 to 66,000 volts for immediate shipment.

WE BUY MODERN TYPE TRANSFORMERS—ANY SIZE—ANY QUANTITY.

The ELECTRIC SERVICE CO. Inc.

America's Used Transformer Clearing House

212 Walnut Street Cincinnati, Ohio

3 ph., 550 v. 25 cy. BARGAINS

				Price ea.
2—	10 hp.	General Electric KT	750 r.p.m.	$ 75.00
4—	15 hp.	General Electric KT	750 r.p.m.	85.00
8—	25 hp.	General Electric KT	750 r.p.m.	97.50
2—	35 hp.	General Electric KT	1,500 r.p.m.	100.00
1—	50 hp.	General Electric KT	750 r.p.m.	145.00
1—	75 hp.	General Electric KT	1,500 r.p.m.	120.00
2—	100 hp.	General Electric KT	750 r.p.m.	165.00
2—	150 hp.	General Electric KT	750 r.p.m. (3 bearing)	190.00

SLIP RING

6—	15 hp.	General Electric IM	750 r.p.m.	90.00
3—	25 hp.	General Electric MT	750 r.p.m.	140.00
1—	37 hp.	General Electric ITC	500 r.p.m.	180.00
1—	40 hp.	General Electric MT	750 r.p.m.	195.00

Motors complete with bases only and guaranteed in perfect condition.

R. Scheinert, Almond & Hagert Sts., Phila., Pa.

SELECT BARGAINS

Slip Ring Motors, 3 Ph., 60 Cy.

1—200-hp. Westing., Type CW, 220/440 volt, 514 r.p.m.
2—200-hp. Fairbanks-Morse, Type BV, 220/440 volt, 600 r.p.m.
1—100-hp. Burke Elec. Type EMV, 2200 volt, 900 r.p.m.
1—75-hp. Westing. Type MW, 220/440 volt, 850 r.p.m.
2—75-hp. Gen. Elec. 2200 volt, Form M, 695 r.p.m.
2—75-hp. Gen. Elec. Type 1 Form M, 440 volt, 720 r.p.m.

Synchronous Motor Generator Sets

8 New Westinghouse 3 Bearing, A.C., Type G, 50 Kva., 220 v., 3 ph., 60 cy., 1200 r.p.m., D.C., Type SK-150L, 125 volt.

Photo, Particulars and Price on Request.

See last week's listing

MOTORS—GENERATORS—TRANSFORMERS AND OTHER ELECTRICAL EQUIPMENT

Belyea Co., Inc., 151 W. 18 St. New York City

REBUILT—GUARANTEED

LAND

MOTOR BARGAINS

New and Used Selected Bargains

Squirrel Cage Motors (3 ph. 60 cy., 220/440)

15	Sturtevant	3600	
15	G. E.	1800	K. T.
15	G. E.	1200	K. T.
15	C. W.	1200	
15	Westghse.	900	C. S.
15	Wagner	900	B. N.
15	G. E.	1200	K. T. E.
10	G. E.	1800	K. T.
10	G. E.	1200	K. T.
10	Westghse.	1200	C. S.
10	Allis-Chal.	900	
10	G. E.	900	K. T.
10	G. E.	720	K. T.
10	G. E.	720	C. S.
10	G. E.	600	K. T.

Large stock of Motors from ¼ to 300 hp. Also Generators and Motor Generator Sets of all characteristics.

L. J. LAND, 207 Centre St., N. Y. C.

BARGAINS

New General Electric Transformers Priced to Sell

20—5 kva., type HJ, single phase, 60 cycle, 5500/11000/19100Y to 220 volts, $60.00 each.

20—10 kva., type HJ, single phase, 60 cycle, 5500/11000/19100Y to 220 volts, $80.00 each.

12—20 kva., type HJ, single phase, 60 cycle, 5500/11000/19100Y to 220 volts, $115.00 each.

4—300 kva., type HJ, single phase, 60 cycle, 66000/33000/37200Y to 5500/11000/19100Y, Lot of 4, $3000.00.

Turbo Generators, Various Sizes; Also large stock Transformers, Engine Driven Units, Motor Generators, Motors, Dynamos of all descriptions.

GEORGE SACHSENMAIER CO.

8401 Hegerman St., Holmesburg, Phila., Pa.

Get YOUR *wants into the* SEARCHLIGHT

Diesel Engine

1—150 Hp. Fairbanks-Morse Diesel Engine direct connected to 125 kva., 2 ph., 60 cy., 230 v., 257 r.p.m. Generator—Set up to run on stand by service only, but never used—Perfect condition.

FS-241, Electrical World
Tenth Ave. at 36th St., New York City

Coil Making Equipment

Complete set of Browning Equipment with Segur Taping Machine. This equipment has been used very little and cost us over $1000. Best cash offer up to and including January 15th takes it.

Electrical Repair & Equipment Co.
1160 Bryant St., San Francisco, Calif.

3 PHASE GENERATORS

120 kw., 900 r.p.m., 220/440 v., 60 cy.
100 kw., 900 r.p.m., 2,300 v., 60 cy.
62½ kw., 900 r.p.m., 2,300 v., 60 cy.
50 kw., 1,200 r.p.m., 2,300 v., 60 cy.
40 kw. 1,200 r.p.m., 2,300 v., 60 cy.
30 kw., 750 r.p.m., 220/440 v., 25 cy.

V. M. NUSSBAUM & CO.
Fort Wayne, Ind.

Why Save It?

Equipment you have replaced, or for which you have no further use can probably be sold at a good price now. Later it may not be worth as much.

Weed out equipment and let a

"Searchlight" Ad

help you sell it promptly

G-9

HIGH GRADE STANDARD EQUIPMENT

Slip Ring Motors—3 Ph., 60 Cy.

Hp.	Volts	Make	Speed
200	440-220	G.E.	450
200	220-440	G.E.	600
150	2200	G.E.	450
150	220-440-550	G.E.	600
100	440-220	G.E.	720
75	440-220	G.E.	900
60	550	G.E.	900
60	2200	G.E.	600
50	550	G.E.	514
50	220-440	G.E.	1200
50	220-440	G.E.	900
30	220-440	Westghse.	900
25	220-440	G.E.	900
25	220-440	G.E.	1200
25	2200	G.E.	200

Sq. Ca. Motors—3 Ph., 60 Cy.

150	2200	G.E.	514
150	440–220	G.E.	1200
100	550	G.E.	900
100	220-440	G.E.	900
75	220-440	G.E.	900
75	220-440	G.E.	720
60	2200	G.E.	900
50	220-440	G.E.	900
50	550	G.E.	900
40	220-440	G.E.	1200
30	220-440	G.E.	1200

Direct Current Motors

Kw.	Volts	Speed	Make	Type
150	230	875	General Electric	DLC
130	115	1200	General Electric	RC
125	115	900	General Electric	RC
100	230	950	General Electric	RC
75	230	600	General Electric	DLC
75	230	700	Westghse.	S
50	230	650	General Electric	RC

Direct Current Generators

200	250	850	Westghse.	SK
125	125	1050	G.E.	RC
100	250/125	950	General Electric	RC
90	125	1150	General Electric	RC
75	250	700	General Electric	DLC
75	250	850	G.E.	CLB
65	125	800	Westghse.	SK
50	250	800	General Electric	RC
35	125	850	General Electric	DLC

Motor Generator Sets

1—220-kw., 250-v., 514-r.p.m., Westghse, D.C. with 300-kva., 2200-v., 3-ph., 60-cy., syn.
1—150-kw., 250-125-v., 3 wire, 720-r.p.m., Crocker-Wheeler Generator connected to 200-hp., 2200-440-v., 3-ph., 60-cy., synchronous G. E. motor.

A. C. Generators

1—187-kva., 720-r.p.m., 2200–440–220-v., 3-ph. 60-cy., G. E. belted exciter.
1—150-kw., 600-r.p.m., 2200–440–220 G. E. belted exciter.
1—115-kva., 900-r.p.m., 2200-v., 3-ph., 60-cy., Allis-Chalmers, direct connected exciter.
1—112½-kva. 900-r.p.m., 2200-v., 3-ph., 60-cy., G. E. direct connected exciter.
1—190-kva., 900-r.p.m., 480-240-v. 3-ph., 60-cy., G. E. belted exciter.
1—30-kw., 1200-r.p.m., 2300–440–220-v., 3-ph. 60-cy., G. E. belted exciter.

Synchronous Motors—3 Ph., 60 Cy.

Hp	Volts	Make	Speed
240	2200–440	G.E.	720
200	440–220	G.E.	600
160	440–220	G.E.	600
135	2200–550	G.E.	900
110	2200	G.E.	900
100	2200–440–220	G.E.	720
80	2200–440–220	G.E.	1200
70	550	Westghse.	1200

Engine Generator Sets

1—55-kw., 2300–480–240-v., 300-r.p.m., G.E Type ATB, connected to 11x12 Ames side crank engine.

STEPHEN HALL & CO., INC., 7th and Adams Sts., HOBOKEN, N. J.

An Inventory representing several million dollars of going units is released for quick sale on a bargain basis, because of replacement of local plants by transmission service. Excellence of physical condition certified.

ENGINE AND TURBO UNITS — **HIGH PRESSURE BOILERS** — **POWER PLANT APPARATUS**

Mail or wire specifications of your requirements

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OFFERS BIG BARGAINS
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Used and Rebuilt Engine Generator Sets, Turbo Generator Sets, Motors, Rotary Converters, Generators, Motor Generator Sets, Engines, Boilers, Steam and Electric Machinery of all kinds also Machine Tools. Send for our new machinery list. Yours for the asking.

The RANDLE MACHINERY CO.
1822 Powers St., Cincinnati, O.

FOR SALE

Two General Electric Co.'s Series Mercury • Arc Rectifiers

Primary Voltage 2200.
D.C. Voltage 2250 and 4500.
D.C. Current 6.6 amp.

These rectifiers are in splendid condition and will be sold cheap.

Mississippi Valley Public Service Company
Winona, Minn.

Brand New 32 Volt Motors
(Holtzer-Cabot)

37—HD-18, 1/6 hp., 32 volts, D.C., 1750 speed at $7.00 each.
39—HD-18, ¼ hp., 32 volts, D.C., 1750 speed at $8.00 each.
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SAMUEL FELDMAN, Inc.
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GENERAL ELECTRIC VOLTAGE REGULATORS

We have a number of 100 amp. 60 cycle, 2300 volt, type IRS, General Electric Voltage Regulators, complete with operating motor, relay, resistor, contact making voltmeter, current transformer, which we will sell for $200.00 each. At this price there is no excuse for not giving your customers good voltage regulation.

GEORGE SACHSENMAIER CO.
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FOR SALE

STEAM TURBOS 60 Cy. 3 Ph.

1875 Kva., 6600/2200 v., 3 ph.
3125 Kva., 4000/2300 v., 60 cy., 3 ph.
1500 Kva., 2400 v., 60 cy., 3 ph.
1—7500 Kw., 2300 v., 60 cy., 3 ph.
1—15000 KVA., 2300 VOLT, 60 CY., 3 PH.

MIXED-LOW PRESS TURBOS
1500 Kva. (bleeder), 480/2300 v.

MOTORS—60 cy., 3 ph.
50—100-200-300-400-500-600-800-1000 hp.

MISCELLANEOUS EQUIPMENT
NEW 1½ TON ELEC. FURNACE
165—75 Kva. Gas Eng.'s, 240 v. 3 ph.
60 CY., 3 PH. ENG. SETS
1650—1250—750—600—175 KW.
NEW 1,000 HP., 200-LB. BOILER

ROSS POWER EQUIPMENT CO.
Indianapolis, Ind.

Frequency Changers

25 to 60 Cycle

3—500 kva., General Electric Generator, 2400 volt, 62½ cycle. Motor 6600 volt, 25 cycle.

Pumps

1—DeLaval, 35-ft. head, 500 GPM.
1—Platt, 400-ft. head, 300 GPM.
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1—Platt, 35-ft. head, 2400 GPM.
1—Platt, 40-ft. head, 1200 GPM.
1—Platt, 20-ft. head, 1900 GPM.
1—24-in. Worthington Drainage Pump, 15-ft. head, 20,000 GPM.
2—100 hp. Worthingtons with Generators.

Rotary Converters

General Electric, 125-250 volt D.C., 25 cycle on A.C. side.

2—400 kw., 2—750 kw., 2—1500 kw., 2—2000 kw.

Complete stock of equipment for distribution systems and industrial plants.

Address, Attention W. C. Blair, Industrial Engineer

KANSAS CITY POWER & LIGHT COMPANY

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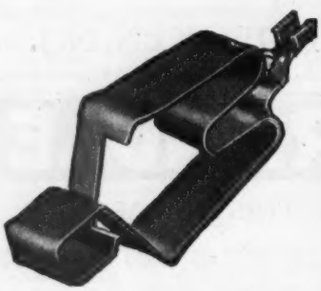
PATENTED

Practically designed and made better—

These clips work better, handle easier and last longer. It is not an assembled clip but one that is carefully made from one piece of special spring steel. Carries current naturally and easy. Three sizes cover every need.

These clips are strongly made. They are safe to handle. Grip tightest and make thorough contact.



Cheapest because they last longest

- One-Piece
- Special Spring Steel
- Handy Terminal
- Safety Hand Grip
- Hot Lead Coated
- Universal Jaws
- Generous Size
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- Perfect Contact
- Easy to Clean

Ask for sample. Sold by Jobbers.

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Compounds, Waxes & Paints
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BEST BY TEST

Made for Your Particular Requirements

Are you interested in securing sheets distinctive for uniformity, low core losses, high permeability and exceptional punching qualities?

We maintain, at your service, a highly specialized department for the production and betterment of Electrical Steel sheets.

Submit Your Inquiries

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CLEAN INSIDE—Made in our own open hearth furnaces, using the latest and most progressive methods to get good clean steel.

CLEAN OUTSIDE—Rolled and treated with utmost care to obtain high quality and uniformity in all respects.

RESULTS—Better magnetic performance, best die service.

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BAKELITE

THE MATERIAL OF A THOUSAND USES

Molding Materials; Laminated Sheets, Tubes and Rods; Lacquers, Varnishes and Cements.

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RUBBER—PAPER—CAMBRIC INSULATED CABLES

SAFETY CABLE COMPANY

Division of General Cable Corporation

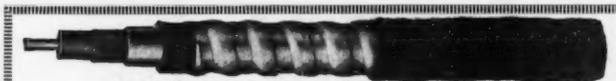
CHICAGO NEW YORK BOSTON
SAN FRANCISCO

"GARFIELD" INSULATION

GUMMON

"GUMMON" is the standard and original Cold Molded Insulation, made by the oldest and largest producer. Continuously improved to meet increasingly exacting requirements.

GARFIELD MFG. CO.
Garfield, N. J.



"Spiraloc" Interlocking Steel Tape Armored Cable

Standard Underground Cable Co.
Division of General Cable Corp.
Manufacturers of Electric Wires, Cables, Accessories.
General Office: Pittsburgh, Pa.
Branch Sales Offices in principal cities.

WEATHERPROOF "O.K." WIRES AND CABLES

WEATHERPROOF
RUBBER COVERED
SLOW BURNING
BARE COPPER WIRE

RUBBER COVERED "PARAC" WIRES AND CABLES

PHILLIPS WIRE COMPANY
Division of General Cable Corporation
PAWTUCKET, R. I.

"Opportunity" Advertising:

Think *"SEARCHLIGHT"* First!

0096

THE WORLD'S STANDARD

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Black and Yellow
Varnished Silk, Varnished Cambric, Varnished Paper

Irv-O-Slot Insulation Flexible Varnished Tubing
Insulating Varnishes and Compounds

Irvington Varnish & Insulator Co.
Irvington, N. J.

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SHEETS
RODS
TUBES
SHAPES

Graded to your requirements

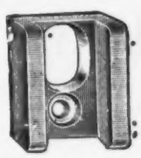
Paper base
Canvas base

PHENOLITE
Laminated BAKELITE

SHEETS
RODS
TUBES
SHAPES

PEERLESS INSULATION

NATIONAL VULCANIZED FIBRE CO.
WILMINGTON DEL., U. S. A.
Offices in principal cities



Why LAVA Insulators?

Unaffected by heat, they preserve both mechanical and electrical strength.

Ask for Kruesi's Book.

AMERICAN LAVA CORPORATION
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They Must Not Fail

CONTACT Points, of all things, must be absolutely reliable—so much depends upon their proper functioning. Long experience and extra care in manufacturing have made Baker Contact Points the safe, reliable units they are. They may be had of Platinum, Iridio-Platinum, Silver and Special Alloys. We shall be glad to send you detailed descriptions.

BAKER & CO., INC.
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ALUMINUM

In Every Commercial Form

Electrical Conductors, Conduit, Condenser Foil; Paint Powder, Etc.

Aluminum Company of America — Oliver Bldg., Pittsburgh, Penna.

INSULATED WIRES and CABLES
"Okonite," "Manson" and Dundee "A," "B" Tapes
Send for Handbook
THE OKONITE COMPANY
THE OKONITE-CALLENDER CABLE COMPANY, INC.
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Sales Offices: New York, Chicago, San Francisco, St. Louis, Atlanta, Birmingham, Pittsburgh, Seattle, Los Angeles, Pettingell-Andrews Co., Boston, Mass; F. D. Lawrence Electric Co., Cincinnati, O.; Novelty Electric Co., Phila., Pa.
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Purity—

Important Fibre Requirement

Essential requirements of highest grade Vulcanized Fibre are pure paper, pure chemical bath of the proper strength, proper control of temperature and skillful handling throughout. These requirements are recognized in the strictest sense in the manufacture of superior CONTINENTAL VULCANIZED FIBRE.

Only purest raw materials used. Always uniform; therefore dependable. Has higher dielectric and tensile strength. Replaces to advantage wood, hard rubber, leather, porcelain, mica, and many metals. Sold in sheets, rods, tubes and finished parts. Colors: Red, black, natural. Study CONTINENTAL VULCANIZED FIBRE, it will pay you. For finest insulation material, investigate Dilecto and Conite. Let a CONTINENTAL Engineer consult with you on your needs, no obligation or cost.

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THE CONTINENTAL FIBRE COMPANY
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Service From:

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San Francisco . . 1575 Folsom Street
Los Angeles . . . 307 S. Hill Street
Seattle . . . 1041 Sixth Avenue, So.

CRAPO

Double Galvanized

Telephone & Telegraph Wire

EBB--BB--STEEL

Double Galvanized

Steel Strand

STANDARD OR COMMERCIAL
SIEMENS-MARTIN
HIGH STRENGTH
EXTRA HIGH STRENGTH

Lower Maintenance Cost,
Longer Life insured through

CRAPO
Galvanizing

Representative Supply Jobbers are prepared to serve your instant wants

Indiana Steel & Wire Company
Muncie, Indiana

Note Protection at Corners

Blake Insulated Staples

Unequalled for telephone and bell wiring. The fibre insulation prevents troublesome short circuits and grounds. 4 sizes. Pat. Nov., 1900. Write for Samples.

Blake Signal & Mfg. Co.
Boston, Mass.

Monson Slate

Best for Switchboards

Monson Slate is recognized throughout the industry for its uniform high quality.

To meet a rapidly increasing demand we have expanded our producing facilities to double their former capacity.

Users of Monson Slate are thus assured of prompt attention and service.

Let us tell you how Monson Slate will serve to enhance the quality of your products.

Portland-Monson Slate Co.
Portland, Me.—Quarries at Monson, Me.

LONG LIFE ON THE LINE

"AMERICAN BRAND" WEATHERPROOF WIRE AND CABLE

All year 'round wire that will not crack, peel or drip in any weather or temperature.

AMERICAN INSULATED WIRE & CABLE CO.
(Migers of "A-1 BRAND" Magnet Wire)
Chicago, Ill.

HARD PORCELAIN

For Electrical Specialties

IMPERIAL PORCELAIN WORKS
TRENTON, N. J

"LAVITE"

A Superior Insulation
Strong, Accurate, Everlasting

D. M. Steward Mfg. Co.
Chattanooga, Tenn.

BELL
NORTHERN **CEDAR POLES** WESTERN
BUTT TREATING ANY KIND REQUIRED
BELL LUMBER CO., *Minneapolis, Minn.*

ELECTRICAL WIRES and CABLES

ROEBLING

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SAMSON SPOT CORD
FOR HANGING ARC LAMPS

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SOLID BRAIDED COTTON—WATER PROOFED
Send for Catalogue and Samples
SAMSON CORDAGE WORKS, BOSTON, MASS.

Non-Rusting

"COPPERWELD"

WIRE—STRAND—RODS

ARISTOS COPPERWELD

There is no other "copper-covered steel" or "copper-clad steel" made like COPPERWELD—by the Molten Welding Process.

IT CANNOT RUST

Copperweld Steel Company

MAIN OFFICE & MILLS—GLASSPORT, PA.
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STEEL STRUCTURES
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Transmission Lines
To Meet Every Requirement
AERMOTOR CO.
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Lapp Insulators
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Trade Mark

OUTDOOR & INDOOR
SWITCHING & SUB-STATION
EQUIPMENT
The CHAMPION SWITCH COMPANY
KENOVA W.VA.

TWO spoon type shovels to meet all needs

These spoons were carefully designed to meet the particular requirements in the class of work for which they are employed. Their great strength runs uniform. The blades are stiff and will not bend. The handles are extra large, well balanced and tapered for ease of grip. Natural black finish blades wear better, clean better and resist rust.

Quick shipments.
Ask for catalog.

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OSHKOSH, WISCONSIN
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POLE LINE
CONSTRUCTION TOOLS

Thomas Quality Insulators
Manufactured by
THE R. THOMAS & SONS CO.
East Liverpool, Ohio, U. S. A.
Est. 1873
New York Boston Chicago London

Pole Top Switches
Disconnecting Switches
Switching Equipment for Manual and Motor Operation
Outdoor Substations
Bus Supports, Choke Coils for Indoor and Outdoor Service
Switchboard Fittings
Copper Fittings
Control Switches
for the good of the Service
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CHESTNUT POLES
BUTT TREATED
THE FRANKFORT LUMBER CO.
16 EAST BROAD STREET, COLUMBUS, OHIO
Creosoting Plant and Storage Yards ---------- Athens, Ohio

"THREE"
HIGH QUALITY
LINE AND STATION EQUIPMENT
Electrical Engineers Equipment Co.
General Offices: 25th Ave. at Division St.
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Sales Offices in all principal cities

Steel Transmission Towers
and Special Structures
Substation Structures
ARCHBOLD-BRADY CO.
Engineers and Contractors SYRACUSE, N. Y.

Steel Transmission Towers
RITER-CONLEY COMPANY
Pittsburgh

"Bates Poles Outlive the Bond Issues that Buy Them"
BATES POLES AND STRUCTURES
Bates Expanded Steel Truss Co.
General Offices and Plants
EAST CHICAGO, INDIANA, U. S. A.

SUNDH *Electric Co.*

Automatic Starters
Circuit Breakers
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Trade Mark
Magnet Switches
Pressure Regulators
Remote Switches
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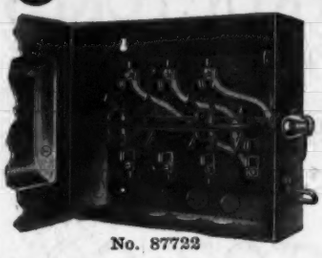
Valve Control

WRITE FOR CATALOG

Sundh Electric Co., No. 3 Ave. C, Newark, N. J.

Branch Offices or Sales Representatives in Principal Cities

POLE CHANGING SWITCHES



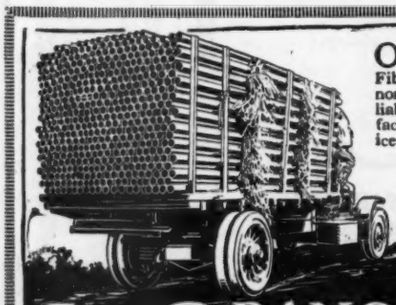
No. 87722

For use with 3 Phase Motors, with the windings arranged for two speeds. Can be used on the following types:
1—Two speed—constant hp.
2—Two speed — constant torque.
Made in 30 and 60 Amp. sizes for 250 and 600 v.a.v. 600 Volt Switches are equipped with "Snuf Arcs."

Send for Bulletin No. 7 listing our complete line of Safety Switches and Panel Boards.

THE TRUMBULL ELECTRIC MFG. CO.
Plainville, Conn.

New York Chicago San Francisco Boston
Philadelphia Atlanta Ludlow



OVER thirty years' use has proved Orangeburg Fibre Conduit the most economical, safest and most reliable underground duct. Two factories assure prompt service and deliveries.

Johns-Manville, Corp.
292 Madison Ave.
at 41st St., New York
Sole Selling Agent for the Fibre Conduit Co.

ORANGEBURG FIBRE CONDUIT

CANADIAN PORCELAIN CO., LTD.,

HAMILTON, ONTARIO, CANADA

Specializing

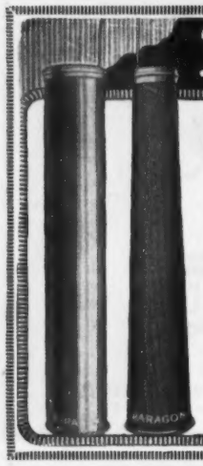
High and Low Voltage Insulators

LSSC

Steel Transmission Towers, Substations, Buildings

LEHIGH STRUCTURAL STEEL CO.
Allentown, Pa.

New York Boston Philadelphia
Washington Miami



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Furnish permanent, effective grounding protection from lightning, high tension crossed and all excess potential.

Heavy continuous copper throughout. All joints spot welded. Insure durability, highest conductivity, lowest resistance to ground, and ample capacity. Inexpensive and easily installed with a post hole auger.

Especially efficient for grounding transformer secondaries. *Write for descriptive literature.*

PARAGON ELECTRIC COMPANY
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PRETTYMAN PRESERVED P27 FOREST PRODUCTS

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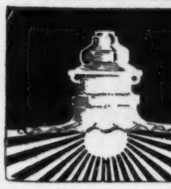
Railroad Cross-ties; Switch-ties; Bridge Timbers; Construction Timbers; Mine Timbers: Lumber; Piling; Poles; Posts and other Forest Products

J. F. Prettyman & Sons
Wood Preserving Plant
Charleston, S. C.



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The complete, quality line of Street Lighting Standards, Fixtures, etc., etc. New Catalog sent on request.

PHILA. ELEC. & MFG. CO.
1228-36 N. 31st St., Phila., Pa.

LANDIS & GYR METERS

The largest and most complete line of electricity meters in the world—all carefully tested and guaranteed to conform to N. E. L. A. Meter Code as to performance. Ask about them.
See page advertisement May 28 issue Electrical World

U. S. Laboratory and Sales Office
HERBERT NEHLS, Vice Pres. & Gen. Mgr.
LANDIS & GYR, INC.
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Sauter — The Swiss automatic time switch

with a record of many years' unmatched performance in all quarters of the U. S. A.

R. W. Cramer & Company, Inc.
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Hubbard and COMPANY
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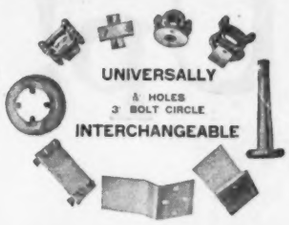
CUTLER HAMMER

Industrial Efficiency Depends on Electrical Control

The CUTLER-HAMMER Mfg. Co.

Pioneer Manufacturers of Electric Control Apparatus

1212 St. Paul Ave., Milwaukee, Wisconsin.



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RAILWAY AND INDUSTRIAL ENGINEERING COMPANY, GREENSBURG, PA.

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CELL STRUCTURES

built from

factory made units afford the greatest saving in time, money and in convenience. *Let Us Show You.*

Deceleco, Incorporated

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TIP'S TOOL CO. INC. TIP'S TOOLS TAYLORVILLE ILL

HOTLINE MAINTENANCE TOOLS

Grounding Sets — Springless Clamps
Fuse Pullers — Hot Wire Cutters

Catalog on Request.

TIP'S TOOL CO., Incorporated
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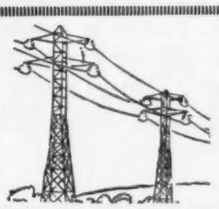
WE EXTEND the facilities of our organization to those desiring information or reports on companies with which we are identified.

Electric Bond and Share Company

(*Incorporated in* 1905)

Paid-up Capital and Surplus, $115,000,000

71 Broadway — New York



GALVANIZE IT!

We have the largest hot dip job galvanizing plant and kettles in the United States.

We have the most modern equipment to do first class galvanizing at lowest prices. Send prints.

Galvanized products furnished.

JOSEPH P. CATTIE & BROTHERS
Gaul & Letterly Sts., Philadelphia, Pa.

EST. 1885 Aimco INC. 1918

"American" INSULATING MACHINERY COMPANY

REG. U.S. PAT. OFF.

519 Huntingdon St.
PHILADELPHIA PENNSYLVANIA U.S.A.

MANUFACTURERS OF MAGNET-WIRE ENAMELING MACHINES, COTTON, SILK, ASBESTOS, PAPER AND OTHER TAPE, WIRE INSULATING MACHINES

Complete Wire Tinning and Wire Electro-Plating Outfits.
Wire Saturating and Polishing Equipment.
Wire-Respooling, Coiling and Wire-Reclaiming Machines.
Automobile-Cable and Pressure-Hose Armoring Machines.
"Aimco-Seward" Patented Panning Machines. Vulcanizing Pans and Patch-Vulcanizers for Rubber Covered Wire.
Pull-Out Capstans. Reel-Stands and Steel Reels.
Electric Railway Automatic Signals and Road Crossing Warning Signals.
Exclusive Agent in the United States, Canada, Mexico, Central and South America for "Breguet" High-Speed Wire-Drawing Machines. Patents applied for in the United States and Patented in France and Great Britain.

REELING STANDS With TRAVERSE for reels 30-in., 36-in., 42-in., 60-in. and 72-in. diameter. SPECIAL MACHINES DESIGNED OR BUILT

PINCO INSULATORS

The Correct Design.

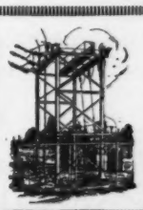
The Porcelain Insulator Corp.
LIMA, N.Y.

BLAW-KNOX COMPANY

PITTSBURGH, PA

BLAW-KNOX

Manufacturers of
TRANSMISSION TOWERS
STEEL BUILDINGS
CLAMSHELL BUCKETS



Switches—Arresters—Fuses—Sub-Station Equipment

HI-VOLTAGE Equipment Company

Cleveland

OFFICE AND FACTORY 3200 CROTON AVENUE

RUGGED DISC INSULATORS

"PROTECT WITH JD TO A GREATER DEGREE."

JEFFERY-DEWITT INSULATOR CO. KENOVA, W. VA. U.S.A.

THICKER PORCELAIN FOR POWER TRANSMISSION SERVICE

KEARNEY

ANCHORS
SWITCHES

CONNECTORS
GUY CLIPS

Write for Catalog

JAMES R. KEARNEY CORPORATION
4222 Clayton Avenue - - ST. LOUIS, MO.

Up!

Up!

Up!

His sales volume responded to

INDUSTRIAL ADVERTISING

LISTEN to this story of a business that pulled itself up by its own boot straps, the story of a manufacturer who defied the trend of general business and gained sales volume regardless.

From a minor position to recognized leadership by steady yearly gains, always exceeding the progress of the industry as a whole—that is what took place and how it was done is an open book.

It was a young business, making machinery supplies and small parts—sort of a line of industrial "notions"—just the type that might be thought too small to employ Industrial Advertising effectively. In the light of what happened, no one can tell this manufacturer that Industrial Advertising cannot be geared to a small business. That is just what he did—

Geared Industrial Advertising to His Business

At the outset the policy was established to specialize on worthwhile markets. Their buying habits were studied intently and a complete plan of Industrial Advertising and Selling was built around their needs. Thoughtful attention was devoted to the selection of industrial publications and the preparation of advertising copy. In team-work fashion both sales and advertising strategy were aimed at one thing—*Recognition by worthwhile buyers.*

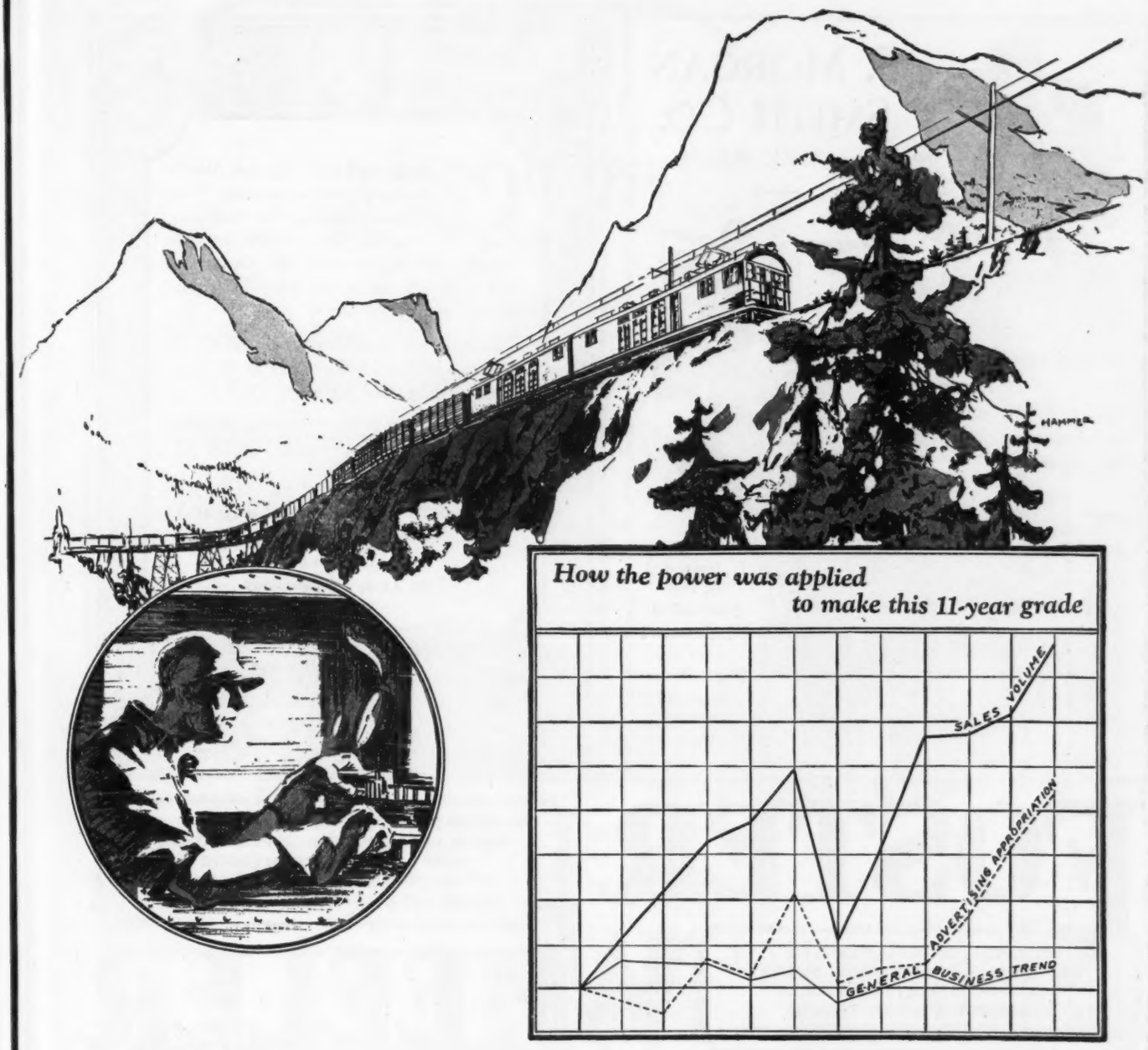
This recognition was found to be the straight line to larger sales volume. Tangible results were greater than a previous inquiry campaign had produced. A check of new buyers against McGraw-Hill subscribers showed that 80% were on both lists.

From each year's business came the wherewithal to produce next year's increase. Eight per cent of gross revenue appropriated for Industrial Advertising produced an average yearly gain in sales volume of nearly 30%. Only once did the manufacturer experiment with a reduced appropriation and this was the only period when he experienced reduced sales. Comparing the three curves of the chart shows that this manufacturer's growth was controlled not so much by general business conditions as by his volume of Industrial Advertising.

Industrial Marketing at Work

After studying hundreds of such successful cases as this, McGraw-Hill prepared its new book, "Industrial Marketing at Work." This book establishes *recognition* as the proper goal of industrial marketing and offers a practical method, in ten logical steps, for its accomplishment.

If your markets lie within any field of industry broader than your strictly local territory a McGraw-Hill representative will gladly discuss this study and present a copy to you or your advertising agency. For promptness, address your nearest McGraw-Hill office.



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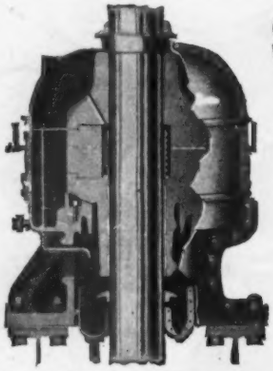

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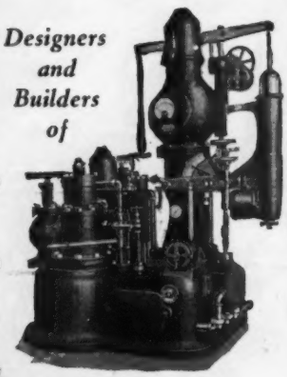
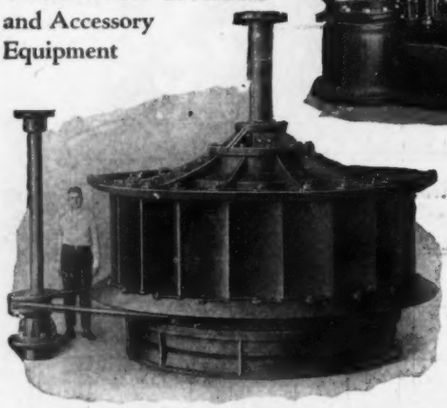


Smith Hydraulic Turbines, Gibbs Thrust Bearings, Water Wheel Governors and Accessory Equipment



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DUE to the fact that ship machinery and hydro-electric equipment have the same characteristics, the turbines, penstocks, towers, etc., built at our Works, are made with the same care and accuracy as is the propelling machinery for ocean liners.

The experienced engineering staff of the Hydro-Electric Division has at its command unsurpassed facilities.

If you will address us on your business letterhead we will be glad to send you an interesting book on hydro-electric equipment: "Beating Swords Into Plowshares."

Newport News Shipbuilding and Drydock Co.

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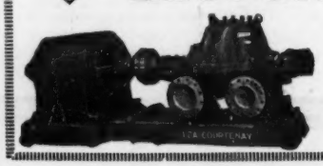
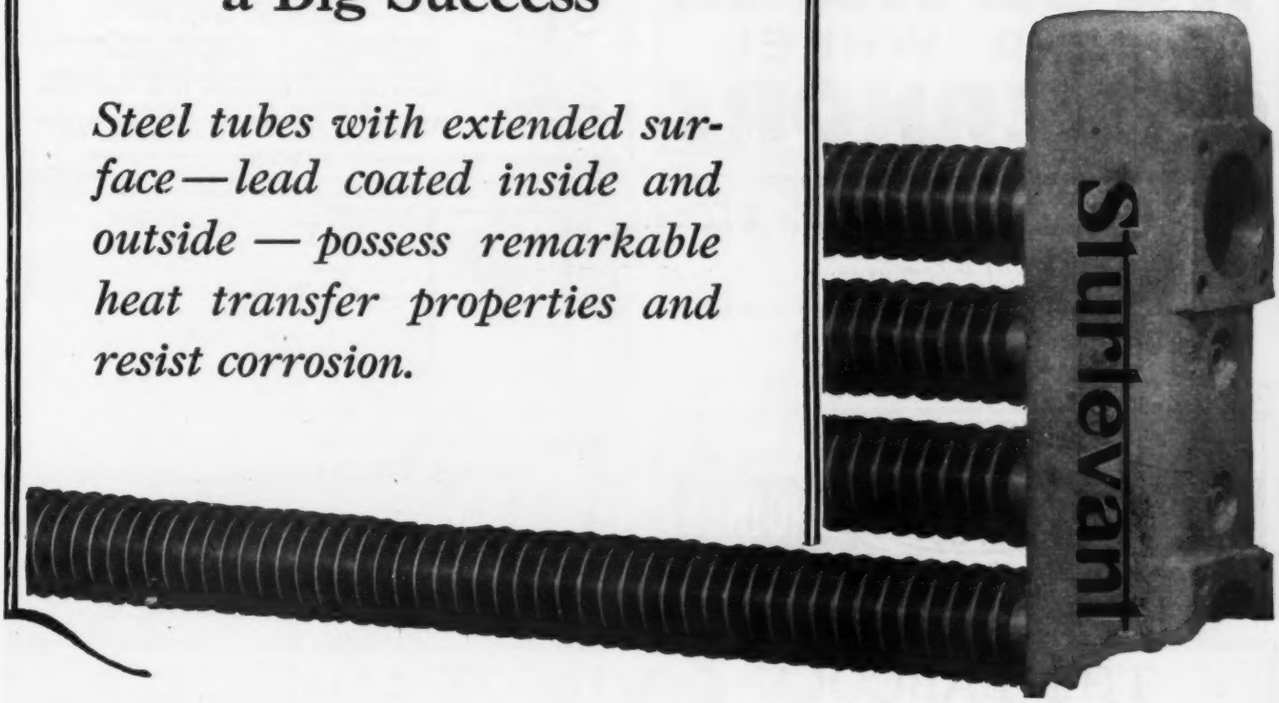


LECOURTENAY CO.
26 MAINE STREET
NEWARK, NEW JERSEY

New Sturtevant Water Economizer a Big Success

Steel tubes with extended surface—lead coated inside and outside — possess remarkable heat transfer properties and resist corrosion.



Sturtevant Products for Power Plants

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- GENERATING SETS
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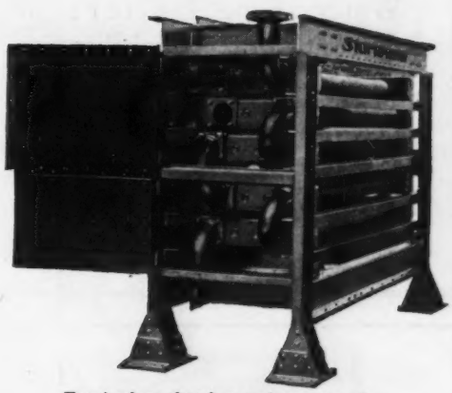
- Feeder Blowers
- Dryer Fans
- Turbo-Undergrate Blowers
- Soot Blowers
- Vacuum Cleaners
- Air Washers
- Transformer Fans

Sixty years' experience, furnishing equipment that is effecting tremendous economies in a multitude of power plants ranging from small industrials to gigantic central stations, was drawn on in developing the new Sturtevant Water Economizer. Oxygen in water and sulphuric acid in waste gases had to be considered seriously—it was a problem and the only satisfactory solution was lead-coated tubes.

The steel discs actually sink into the tubes, thereby insuring maximum heat transfer because of the positive contact between discs and tubes. Other features such as ease of repairing and cleaning are well worth serious consideration.

Complete details in our Bulletin 334. Send for it today.



Front view showing water connection

B. F. STURTEVANT COMPANY, HYDE PARK, BOSTON, MASS.

ATLANTA BOSTON BUFFALO CAMDEN CHICAGO CHARLOTTE CINCINNATI CLEVELAND DALLAS DENVER DETROIT HARTFORD INDIANAPOLIS KANSAS CITY LOS ANGELES MINNEAPOLIS MONTREAL NEW YORK CITY PITTSBURGH PORTLAND ROCHESTER ST. LOUIS SAN FRANCISCO SEATTLE TORONTO WASHINGTON

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Foreign Representatives: American Trading Co., Tokyo. American Trading Co., Shanghai. Ernshaws Docks & Honolulu Iron Works, Manila. Honolulu Iron Works Co., Honolulu, T.H. H. P. Gregory & Co., Ltd., Sydney. Blair Reed & Co., Ltd., Wellington. International General Electric Co., Caracas. International General Electric Co., Bogota. General Machinery Co., Tampico. Pedro Martinto, Inc., Lima. A. E. Barker, Johannesburg.

1751

Sturtevant
(REG·U·S·PAT·OFF.)

CONSULTATION with Woodward engineers and the installation of Woodward Governors will result in the turbines being controlled with entire satisfaction.
"Write for catalogue M"

WOODWARD GOVERNOR CO., Rockford, Ill.

WOODWARD
WATER WHEEL
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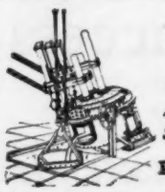
DETROIT ELECTRIC FURNACES
will
Build Power Business
for
THE CENTRAL STATION
Let us help increase your revenue
Detroit Electric Furnace Co.
825 W. Elizabeth St., DETROIT



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Ten Standard Sizes ½ to 24 Tons Capacity
Most Rapid and efficient for making
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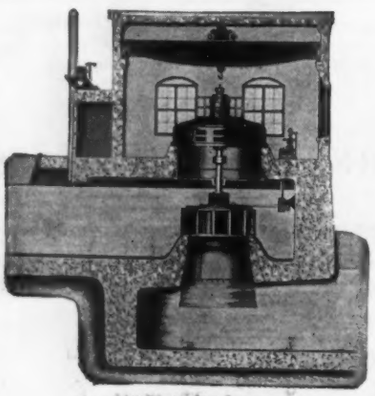
DESIGN 66

TURBINE WATERWHEELS **LEFFEL** TURBINE WATERWHEELS

Design 66 illustrates an up-to-date hydro electric plant equipped with Leffel automatically controlled high speed vertical turbines driving generators direct, installed on a low head water power that had been abandoned many years—That old water power is now a valuable asset. We also furnish Leffel high efficiency—low, medium and high speed—turbines developing thousands of horse power for large capacity hydro electric plants.

Let our engineers show you what can be done.

THE JAMES LEFFEL & CO., SPRINGFIELD, OHIO

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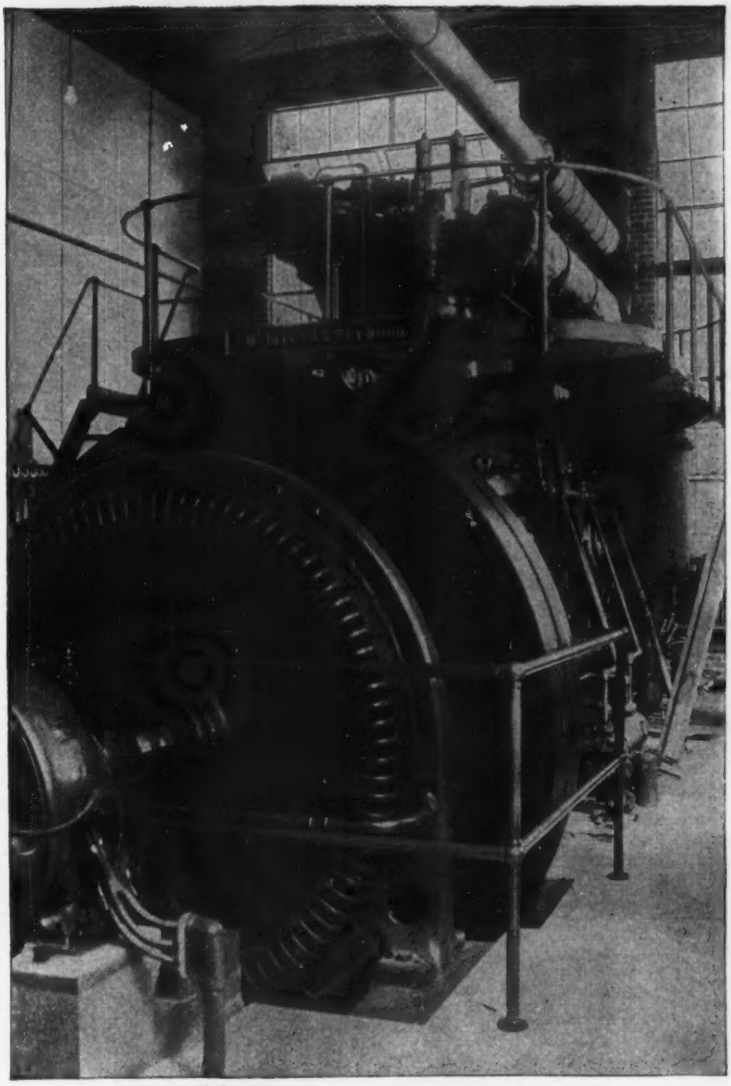
Diesel Power—the remedy in an overloaded or inefficient steam-driven pumping plant

THE White Plains plant of New York Water Service Corporation (a subsidiary of Federal Water Service Corporation) furnishes water to White Plains and Castle Heights at wholesale, serves a few local customers at retail, and provides water for locomotives in the North White Plains yards of the New York Central Railroad.



300-B.hp. McIntosh & Seymour Diesel Engine at White Plains plant, N. Y. Water Service Corporation.

Arrangements had been made by previous owners to install a new boiler and new triple-expansion pumping engine of two million gal. per day capacity, this engine to be located in a deep pit with direct suction from a series of new wells.

The new owners, under direction of L. A. Phillips, Vice-President, rejected these plans as expensive and wasteful in operation and instead erected a new power house with 300-b.hp. McIntosh & Seymour Diesel Engine direct-connected to a 250-kva. generator. By so doing, electric power could be taken to wells wherever located, and the well area could be developed to its maximum water output.

Two motor-driven deep-well centrifugal pumping units were installed, one in a new well, and the other in an old well that had not been used because the suction lift there was too great for the old steam equipment.

The McIntosh & Seymour Diesel Engine now serves as the main power source and part of the old steam outfit has been kept for standby purposes. With this arrangement the old capacity has been doubled, and with additional wells which are now being drilled, even more water will be handled.

The McIntosh & Seymour Diesel Engine is doing everything that could be expected and has proven entirely satisfactory!

Judicious use of Diesel power to supplant or assist overloaded or inefficient old steam units is in most instances a very desirable way to increase capacity and reduce unit producing costs. Tell us your conditions so our Engineers can submit facts and figures.

Capacities 80 to 10,000 b.hp. in stationary types suitable for central station, municipal lighting, waterworks and industrial power.

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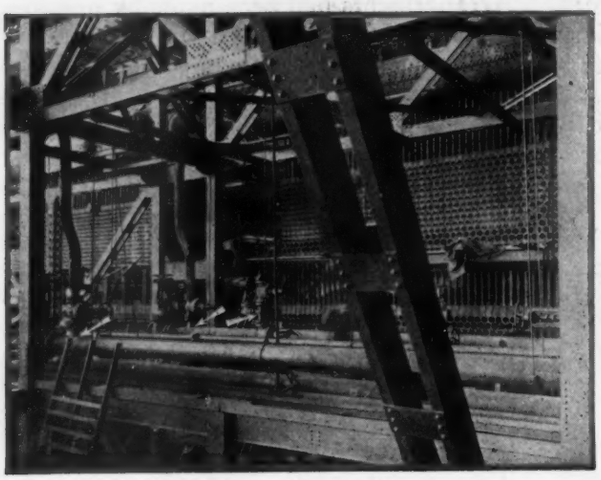
McINTOSH & SEYMOUR DIESEL ENGINES

SAVED! 82 JOINTS



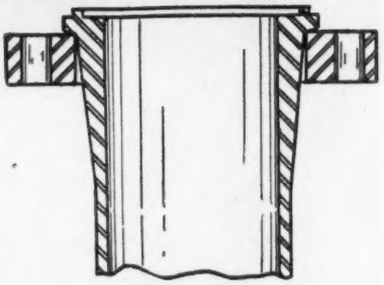
Real Economy Proved by the use of Kellogg Piping

An engineering company gave us an original steam piping layout calling for 344 joints of all sizes. The final layout which we submitted and which was accepted had 262 joints, or a saving of 82.

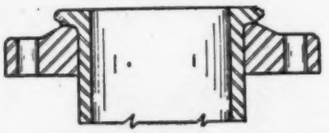
Choice for this job—360 lb. per sq. in. at 750°, rested between two types of piping design. 1st—cast steel fittings and lap welded pipe, using the longest available mill lengths. 2nd—forge and hammer welded nozzles or outlets and forge hammer lap end welds in the pipe. The latter was accepted and the work completed by M. W. Kellogg Co. and an inspection certificate issued by a boiler inspection and insurance company.

This enormous saving was possible only by the elimination of almost one-third of the joints on the high pressure steam lines and was made possible only through use of Kellogg forge welded nozzles in place of cast steel fittings and by use of forge end welds in sizes of 14 in. and larger. Perhaps you have a similar layout. If so, send it to our engineering department. No obligation.

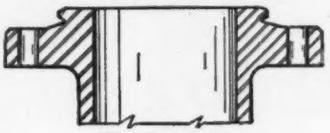
We carry a complete stock of extra heavy iron pipe seamless steel tubing at our plant in Jersey City in sizes from 3 in. to 14 inclusive.



High Hub Forge
Welded Ends
Tongue and Groove
with Swivel Flange



Van Stone Flange Sargol



High Hub Forge
Welded Flange Sargol

M. W. KELLOGG COMPANY
7 Dey Street, New York City, N. Y.

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POWER PLANT PIPING

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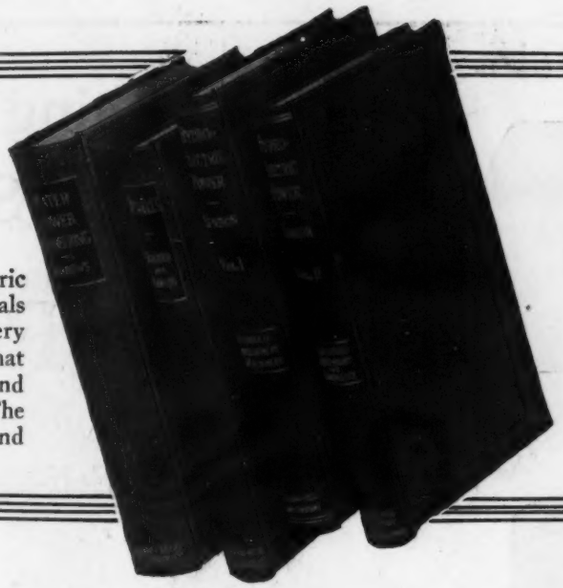
All the information needed in undertaking a hydro-electric project—

THIS new McGraw-Hill Hydro-electric Library contains the bed rock essentials in undertaking a hydro-electric project. Every angle of the field is covered fully. Just what the leading authorities have found to be sound theory and best practice in all phases. The library is in every respect authoritative and complete.



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NORTHWESTERN

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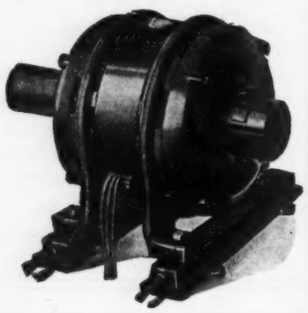
MOTORS



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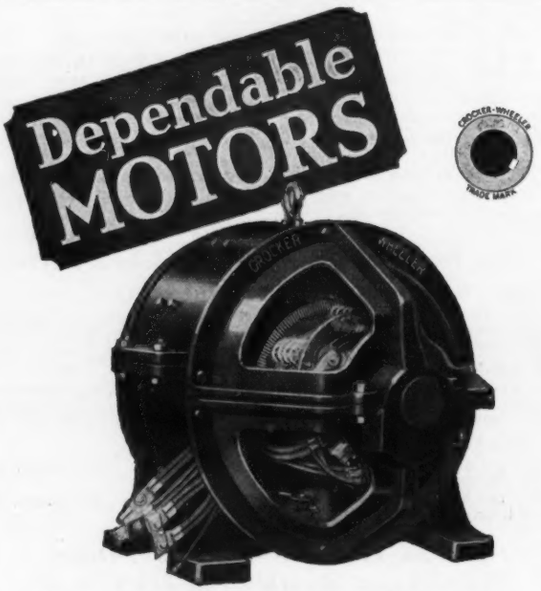

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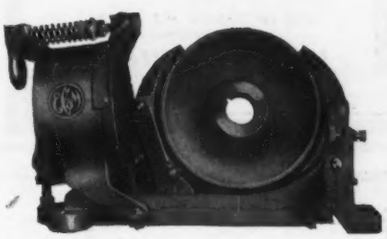
Motor armatures are removed without dismantling the brake and without disturbing any of its adjustments.

Type WB—

the easiest brake to adjust

Many users of the new EC&M Type WB Brake have told us that it is the easiest brake to adjust,—bar none! They point out that the adjustments are so obvious that any electrician or crane operator can make them correctly at the first attempt.

1. To adjust for shoe wear, shorten the air gap by turning the adjusting stud under the magnet.



2. To equalize shoe clearance, turn the adjusting stud which acts as a stop for the right hand shoe arm. This causes both shoe arms to move an equal amount in the same direction.

Many crane users are now specifying EC&M Type WB Brakes when buying new direct current cranes.

Bulletin 1004 gives complete data

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND, OHIO

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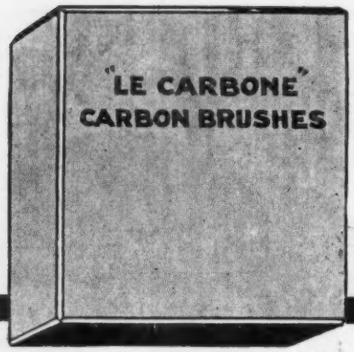

"Le Carbone" Carbon Brushes?

Reason No. 11

They talk for themselves

If it were possible to estimate the number of the tow-ins and the tie-ups which have been avoided by "Le Carbone" Carbon Brushes, these figures easily would constitute the *only* reason needed for their use.

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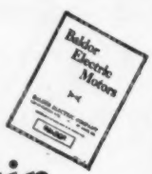

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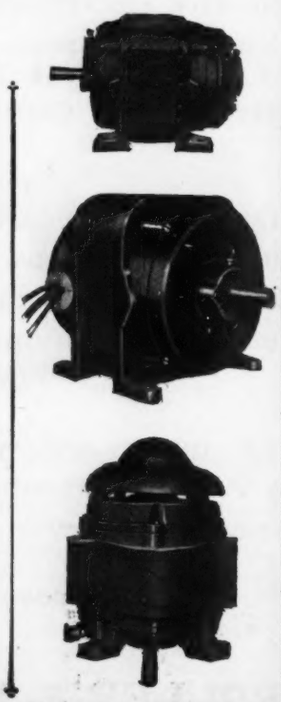

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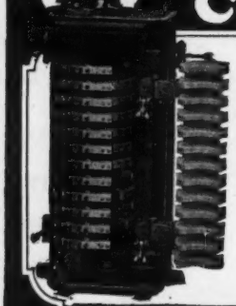

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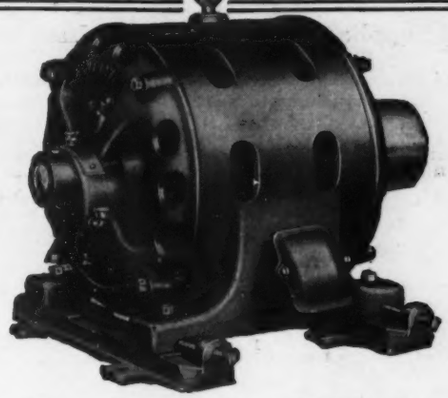

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Because "They Keep a-Running" Century Type RS Repulsion Start Induction Single Phase Motors are particularly fitted for rural and farm service.

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⅛ to 40 H.P. Century MOTORS ⅛ to 40 H.P.

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Equipment, Apparatus and Supplies Advertised in This Issue with Names of Manufacturers

Readers interested in any articles not listed in these pages are cordially invited to inform us of their wants and every effort will be made to put them in touch with the proper manufacturers.

This index is published as a convenience to the reader. Every care is taken to make it accurate, but ELECTRICAL WORLD assumes no responsibility for errors or omissions.

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Pop is ill tempered

"Here, Lad—

casting up the year's business we've done I see that we've slipped from our leading position.

That's discouraging. It must be due to my recent indisposition. I'd better see a doctor."

"No, Pop—

it's due to your DISposition.

And that isn't recent.

Your trouble is in the first word you spoke—CASTING.

Whenever I've mentioned changing from castings to 'Stable-Arc' welding for our machines you've FOUGHT.

That's not indisposition to use the 'Stable-Arc' method. It's purely a matter of your disposition.

And you know, Pop, when it's your disposition, a doctor can't do you any good at all.

It requires turning over a new leaf . . . a leaf of the book at the left."

A new textbook on Arc Welding (Price $1.50) will be sent on approval for five days to any executive requesting it.

Book size, 6" x 9"—total pages, 160—number of illustrations, 200—Charts, 62—Divisions, 8.

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W-26

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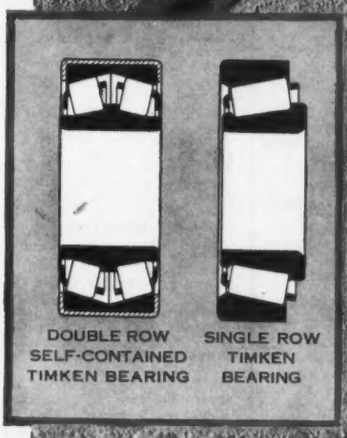

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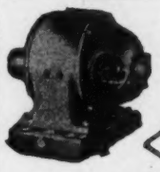

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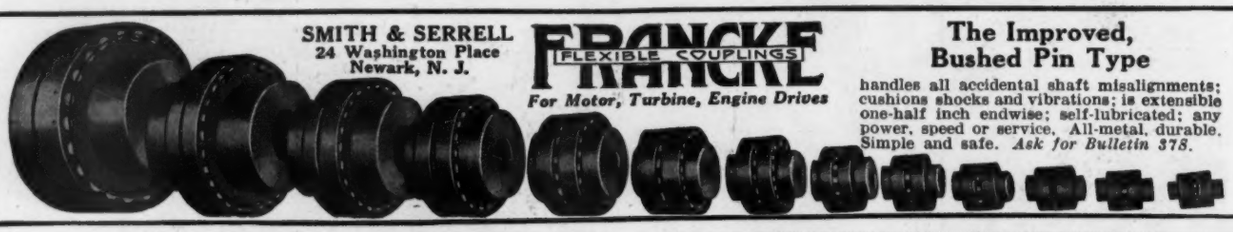

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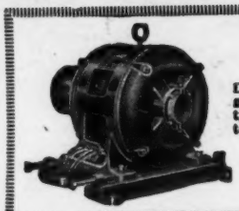

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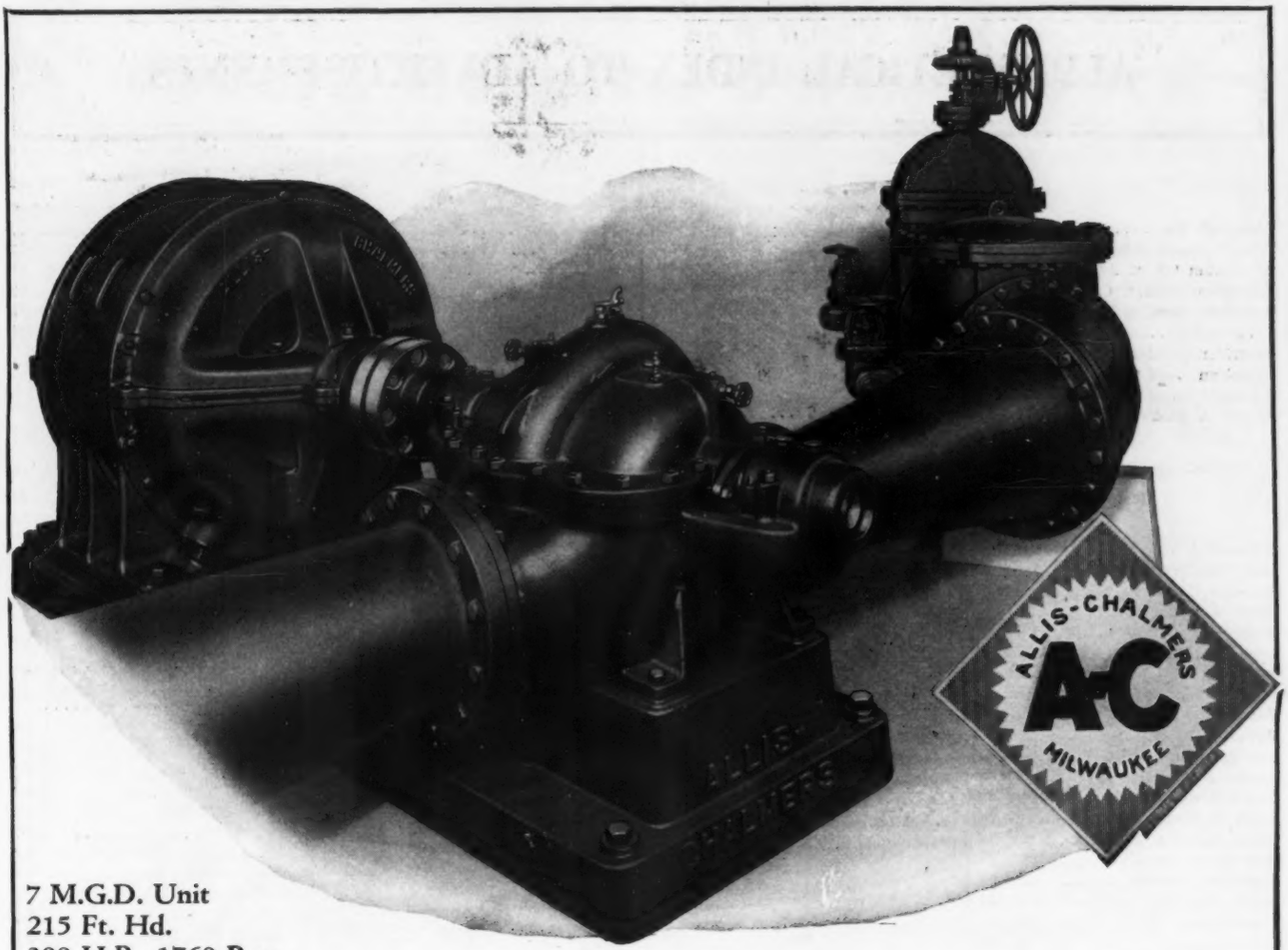

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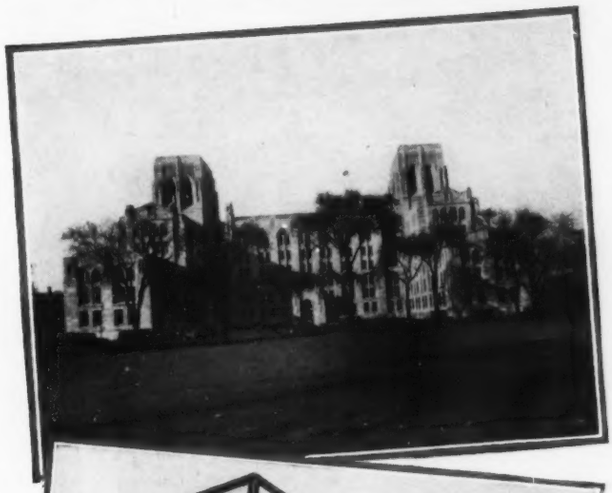

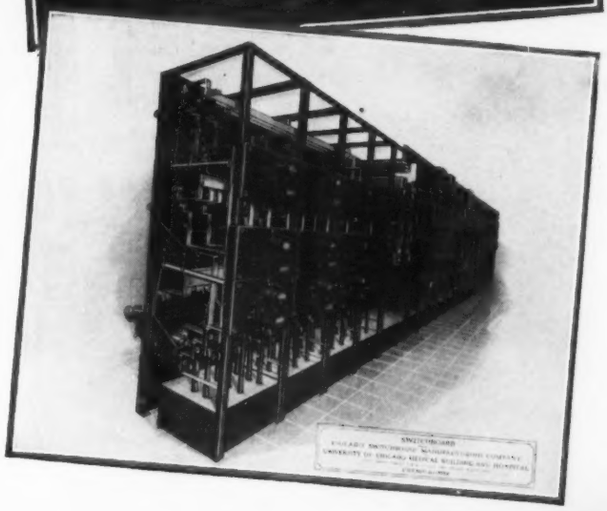

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The I-T-E Circuit Breakers on this switchboard range in capacity from 200 amperes to 2000 amperes. They are all three pole, three coil breakers, with time delay and are non-closable against overload or short.

Near the left-hand end of the board will be seen a solenoid operated transfer breaker which automatically throws in an emergency source of lighting energy in case of failure of the normal. This insures non-interruption to the important operating room lighting—a good practice in hospitals, theatres, etc.

I-T-E Circuit Breakers are available in all capacities and types for the positive protection of A.C. circuits up to 550 volts and D. C. circuits up to 750 volts.

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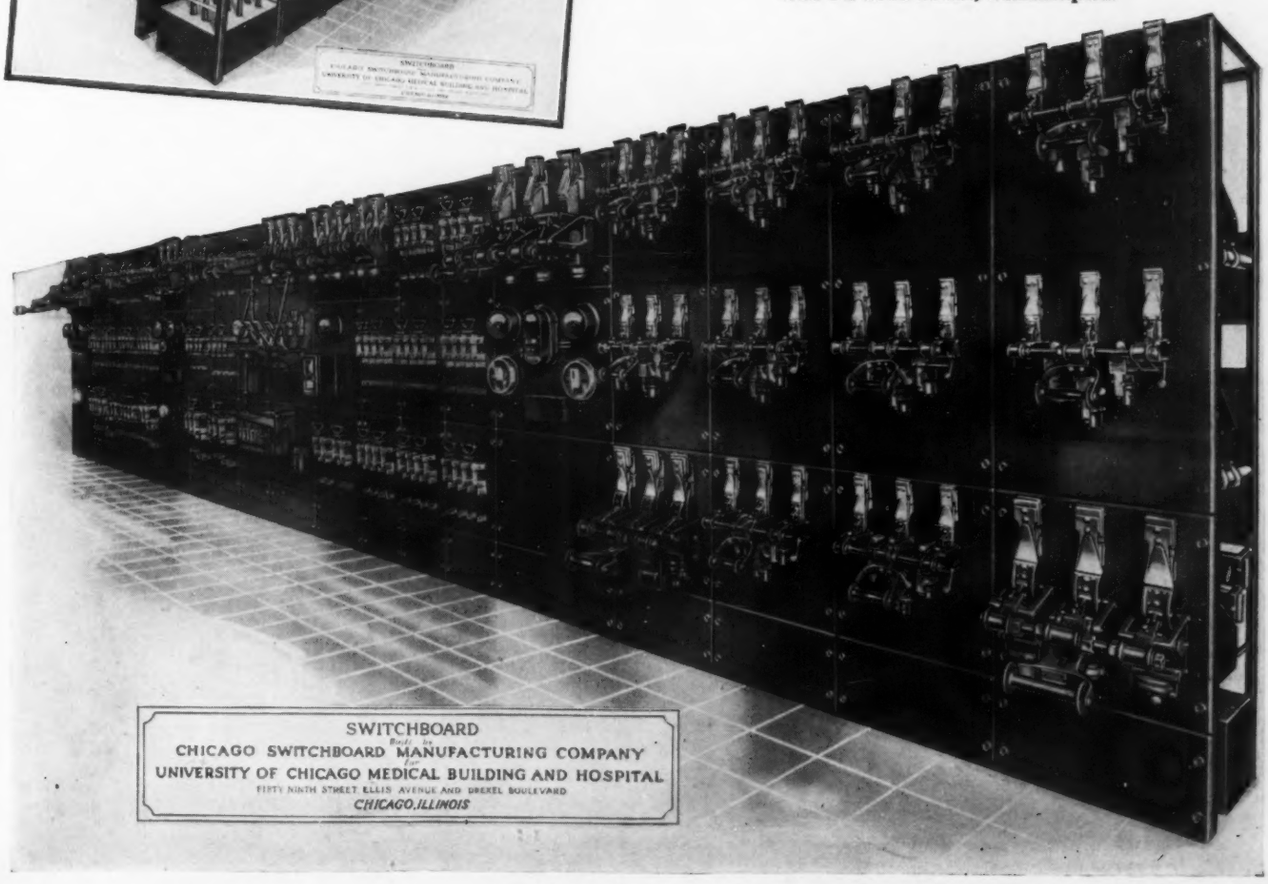
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CHICAGO SWITCHBOARD Built by MANUFACTURING COMPANY
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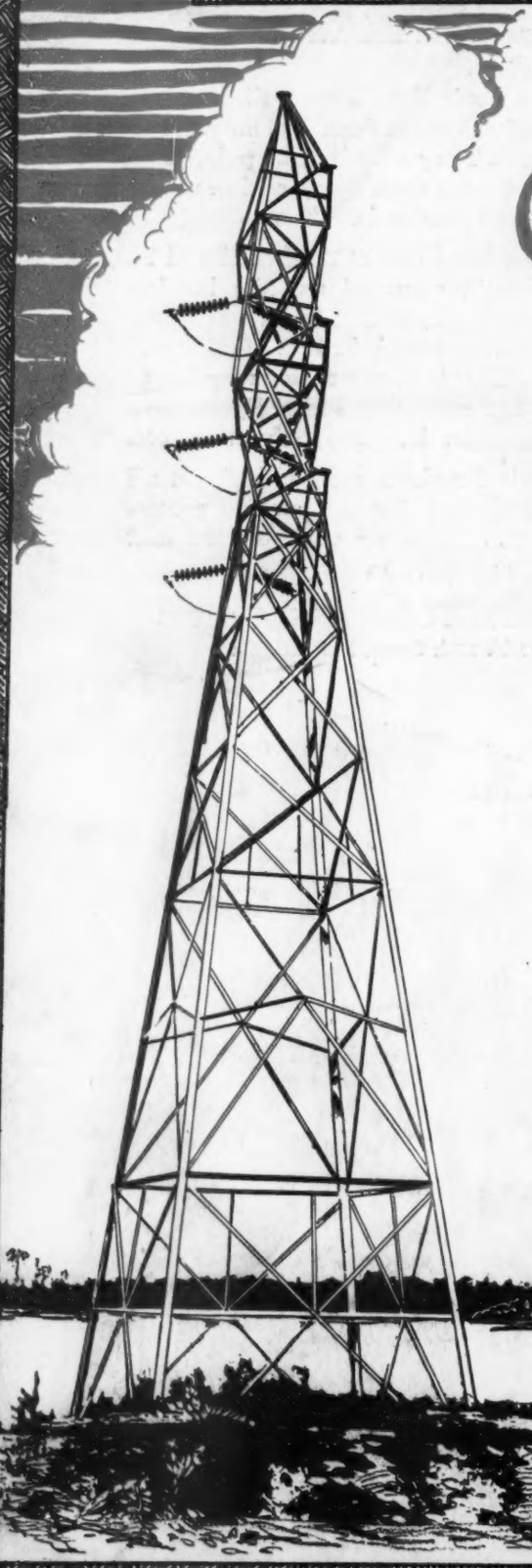

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